TOOKER+ ASSOCIATES

Department of Planning, Housing and Infrastructure

Attn: Elizabeth Kimbell

6 March 2024

Dear Madam,

RE: SES Correspondence to DPHI (29 Jan 2024) regarding
Mirvac Georges Cove Marina Planning Proposal, 146 Newbridge Rd, Moorebank

As you are no doubt aware, Benedict Industries has a Marina approved for its site at Moorebank and that Mirvac has submitted a Planning Proposal (**PP**) to permit residential use on the site to better activate the site and support the Marina consent under DA-611/2018. The PP was supported by Council on the 13 December 2023 to proceed to gateway approval and the Community are overwhelmingly supportive of the proposal offered for the community. During preliminary consultation, DPHI has requested SES to comment on the Mirvac proposal. SES's response is the subject this document and this letter responds to their concerns.

The SES letter (**refer Attachment C**) provides a number of recommendations as to flood-related matters associated with the *Mirvac Georges Cove Marina Planning Proposal* (**PP**).

In summary, the SES recommendations are flawed because critical assumptions relied upon by SES for these recommendations are factually incorrect. Our comments regarding the SES assumptions are that:

1. SES assumed that the PP increases the number in persons and vehicles on the site – the maximum number of persons on site has been estimated by using the number of car parking spaces proposed for the site. The already-approved Benedict Marina development on the subject site has 637 vehicle spaces approved, whereas the Mirvac Marina Planning Proposal has only 592 spaces. Therefore, there is not necessarily an increase in the number of people on site;
2. SES has not recognised that the **proposed building platform** is at RL 7.6m AHD (**1 in 5,000yr flood level**) and is 2m above the 1 in 100 yr flood level, and therefore is not categorised as a high flood risk area. The building platform will be designed to withstand flood debris and uplift loads and will consist of flood compatible materials to minimise flood damages;
3. SES has not recognised that the **lowest residential floor level** is at RL 11.6m AHD and is 1.4m above the **PMF flood level (1 in 1,600,000yr flood);**
4. SES relies upon the Molino Stewart 2022 Georges River Evacuation Modelling – Flood Evacuation Analysis which is considered by flood engineers to be fundamentally flawed – see our previous submissions with regard to this report are in **Attachments A and B**;
5. Both car and pedestrian flood evacuation from the site is possible even based on the conservative SES's *Flood Evacuation Model*'s assumptions. The recently constructed pedestrian bridge over Brickmakers Drive, as actually recommended by Molino Stewart, is now constructed and will be available for pedestrian evacuation from the site. As our flood report for the Planning Proposal demonstrates a vehicular evacuation of sites A, C and D is compliant even with the very conservative SES methodology and there is also a backup, pedestrian evacuation strategy if for any reason the vehicular evacuation fails and for people without a car;

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6. Mirvac's PP's proposed flood evacuation strategy does not solely rely upon a private flood evacuation strategy – and as noted above, there is sufficient time even for an SES-lead flood evacuation in the event of a **1 in 1,600,000yr flood event** (PMF);
7. The Mirvac PP development does not require **additional** SES personnel to organise the flood evacuation from the site because there would be a reduction in the number of persons to be managed. There would also be 24hr Strata Management in place to initiate evacuation far sooner in the event of flood warnings. The Strata Management are responsible for the safety of all the residents.

Moore Point Development

The Moore Point development is located on the foreshore of the Georges River and when fully developed will provide thousands of homes and 23,000 jobs. It received Gateway Approval in April 2023. This Approval was granted based on providing engineered levees to protect the site from the 1 in 100yr floods. The Mirvac PP development protects the site for floods up to 1 in 5000yr **without** relying on the structural integrity of a levee. There is a reliance in the Moore Point development on car and pedestrian flood evacuation (with pedestrian bridges provided crossing the Georges River) up to the 1 in 100yr flood level and hence there is less time allowance for the evacuation compared to the Mirvac PP development. The Moore Point development is adding thousands more people into the Georges River flood affected catchment compared to the Mirvac PP development which actually reduces the number of people subject to flood risk compared to the already-approved Benedict Marina development which the Mirvac PP seeks to modify.

Parramatta CBD Development

The Parramatta CBD is recognized as a major growth area for the future. However, it is the subject of regular (less than 1 in 100yr floods) inundation from Parramatta River and Clay Cliff Creek over a large portion of the CBD. The Parramatta DCP recommends horizontal and vertical flood evacuation strategies. It requires a Flood Emergency Response Plan to be implemented by the body corporate. If horizontal flood evacuation is not possible, then there needs to be a vertical evacuation (Shelter in Place strategy) which requires allocation of sufficient communal area in the building for a community refuge space for residents/tenants whose space is impacted by flooding up to the PMF level. By comparison, there is no habitable areas in the Mirvac PP development which are inundated by the PMF – that is, they are flood free in all flood conditions. Also, the flood affectation in the Mirvac PP will be 1 in 5000yrs compared to the regular flooding in the Parramatta CBD (more frequently than 1 in 100yrs).

Given this comparison and the many more favourable flood related aspects for the Mirvac PP development compared to Moore Point and Parramatta CBD, there are compelling reasons why the Mirvac PP should be given a Gateway approval.

The following sections deal with the SES comments (in order) as in *Attachment A* in their correspondence. The entire SES letter itself is at Attachment C to this report.

SES: "*Increased Exposure to Flood Risks*"

SES need to recognise that there is already an existing approved Marina development for the site and that the Mirvac Planning Proposal seeks to rezone the land to provide supporting residential uses in conjunction with the uses which are already approved. As part of the proposal, it is proposed

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that a car parking cap be provided which would limit the number of people on the site at any one time who would require vehicular evacuation. Also, SES does not recognise that all habitable areas would be located at least 1.4m **above the PMF level**. The proposed building platform for the commercial uses would be located at RL 7.6m AHD (1 in 5000yr flood) and essential services could be easily located above the flood planning level (RL 6.1m AHD) as per the Recommendation 28 in the Flood Inquiry, along with the residential uses being 6m above the 1 in 100 year flood level.

SES: *"Increased Flood Risk to Life"*

The only area subject to *high flood risk* is the small public car park near the public foreshore walk/cycleway on the southeastern corner of the site which has already been approved under DA 611/2018. This is not in any way related to any parking requirement for the proposed residential or commercial uses. It will only be used by the general public for recreational purposes and is no different to many other public parks and boat ramp parking areas along the entirety of the Georges River. Historically, when the weather conditions are inclement for sustained periods (which will give rise to even minor flooding), these recreational related facilities (picnic areas and adjoining carparks) are largely unused. Furthermore, access will be denied to this gated carpark during periods of flood warning.

The SES appears to be unaware that the Planning Proposal proposes that the commercial activities would be located at RL 7.6m AHD (1 in 5000yr flood) and the residential activities would be located a minimum of 1.4m above the PMF (1 in 1,600,000 year flood) which is detailed in the table below. Additionally, the SES appears to have not taken into account that the Planning Proposal and their related "essential services infrastructure" would be located at or above the flood planning level (RL 6.1m AHD as per Recommendation 28 of the *Independent Flood Inquiry report*.

Flood Event	Flood Level		Warning Time Available
1 in 20-year flood event	4.60m AHD		
1 in 100-year flood event Brickmakers Drive for evacuation by car	5.60m AHD		13.6 hours
1 in 100-year flood event + 500mm freeboard	6.10m AHD	**Flood Planning Level plus climate change**	
Adjoining residential development	6.10m AHD		
Essential services infrastructure	**6.10m AHD**		
1 in 2000-year flood event	7.20m AHD		
Pedestrian evacuation via the pedestrian bridge	7.20m AHD		14.6 hours
1 in 5000-year flood event	7.60m AHD		Shelter in place
Building platform and entry to carpark (using a tanked construction) including only retail and community spaces	**7.60m AHD**		
1 in 1,600,000-year flood event	10.20 AHD	**PMF**	
Residential apartments	**11.60 AHD**		

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For the "Extreme Flood" (we assume that SES means the PMF level **with a probability of 1 in 1,600,000 years**), the Mirvac Planning Proposal development will be located on piers, and the building platform is proposed to be at RL 7.6m AHD (1 in 5,000yr flood event). There is more than adequate time based on the conservative SES flood evacuation model to evacuate all the people from the development by car up to the 1 in 100yr flood and all the people by foot before the flood reaches the 1 in 2000yr flood at RL 7.2m AHD.

All habitable areas in the proposed development are located a minimum of 1.4m above the PMF level.

The SES comments focus on the carpark and not on the Planning Proposal development. Furthermore, site flood modelling by Cardno has demonstrated that the proposed Mirvac Planning Proposal development would not create any adverse flooding impacts on adjoining properties.

The flood evacuation would be organised by the SES and assisted by the body corporate personnel, as this will need to be a strata titled development. Flood evacuation is always conservatively assumed to be 100% by car although some 20% of households do not own cars. As such, there has to be a backup for pedestrian evacuation (which is provided by the pedestrian bridge as detailed within the Flood Impact Assessment supporting the Planning Proposal). There would also be a backup electrical generator which will reduce the possible *secondary risks* associated with fires (fire generated by people trying to fix the electrical system and providing further shorts in the system and people using candles for long periods of time which can cause fires) and access to water which has to be pumped to apartments.

Low flood Island

The proposed Planning Proposal development is not a Low Flood Island. The building platform and access from the site is not subject to regular flooding and floods up to RL 3.6m AHD will pass beneath the building. The building platform is located at RL 7.6m AHD (1 in 5000yr flood) and access to Brickmakers Drive is available by car up to the 1 in 100yr flood and higher ground to the west is available for pedestrian evacuation up to the 1 in 2000yr flood at RL 7.2m AHD. There is more than adequate time to evacuate the site even considering the very conservative SES flood evacuation model.

The possibility of secondary risks is minimised by the proposed locating of essential services above the Flood Planning Level as recommended in the *Flood Inquiry Report (Recommendation 28)*. A backup generator will ensure power and water to the development is maintained in a rare case of severe flooding. Residents who chose to stay on site (this will not be recommended) will be located above flood waters. Sewage services will continue as the habitable areas will be located above all flood levels. The availability of a backup generator and the location of critical services above flood levels will reduce the potential for fires during a flood.

Structural Stability of Buildings

The project's Structural Engineers will ensure that the building is designed and constructed to resist flood effects (including debris loads and uplift forces). This is commonly done around Australia and across the globe in flood affected areas.

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The Structural Engineers would consider all flood events in the assessment and design of the structural adequacy of the development. The built design shall be such that the building can withstand floods up to 1 in 5000yrs with zero damage and minimal ancillary (but no structural) damage and no structural damage up to PMF events. Flood compatible materials would be used to minimise the flood damages.

The building will be required to be assessed under the development application process to ensure its structural stability, whereas this planning proposal should relate only to the permissibility of the residential flat buildings and food and beverage premises and not on the individual building designs which will be completed at the development application stage.

Basement Carparking

The SES's statement regarding the basement carparking being affected even in 1 in 20 year is factually incorrect.

The PP's carparking will have a tanked entry/exit driveway crest at RL 7.6m AHD which is **equivalent to a 1 in 5000yr flood** and thus is impervious to floods/effects below this level. The carpark will be tanked and not allow water ingress nor damage below the level of RL 7.6m AHD (1 in 5000yr flood). The detailed design of the basement will be completed at the development application stage, and an applicable consent condition will be applied at the relevant time.

SES: "Increased Demand for Emergency Services"

The proposed development **does not** increase the number of people or cars exposed to the flood risk. There will be less people and cars on site affected by the flooding compared to the approved development for the site. The evacuation will be organised by the SES along with assistance for onsite management from the Body Corporate. No extra SES resources will be required for the flood evacuation due to this Planning Proposal because the number of persons and cars in the development will actually be **reduced** from already-approved consented levels under DA 611/2018.

SES: "Consideration of Climate Change"

The proposed Planning Proposal development will have minimum habitable floor level **which is 1.4m above the PMF level (RL 10.2m AHD) and the majority are well above this level.** These will be elevated **5.5m above** normal building requirements (to be at the FPL RL 6.1m AHD which is the 1:100 yr flood level plus 0.5m) and this significant freeboard will comfortably accommodate the future risks to flood levels due to climate change.

SES: "Risk to Life Treatment Options"

1) **Evacuation**

It is considered that the Molino Stewart flood evacuation analysis is technically flawed as discussed in Attachments A and B. Furthermore, the flood evacuation from this site has already been approved by Council as part of the Benedict Marina development under consent DA 611/2018.

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As noted above, the proposed Mirvac Planning Proposal development reduces the number of people to be evacuated. Car evacuation is the primary evacuation method assumed even though there are other externalities, such as certain households not actually owning vehicles and a substantial reduction in actual home occupancy rate (when people are on holidays, visiting friends, people at work etc) where no vehicular evacuation is required. It has been demonstrated in the Flood Impact Assessment by Tooker and Associates for the Planning Proposal that car evacuation is readily possible in the time available and even if the car evacuation for whatever reason fails (or for those without a car), there is sufficient time to engage a backup pedestrian evacuation based on the SES's own very conservative model by utilising the pedestrian bridge which has been recently constructed by Mirvac for their Georges Cove residences project. The initiation of any flood evacuation is based on an SES order to evacuate with substantial lead times and this evacuation plan has been approved under the DA consent for DA 611/2018.

The severely-constrained lane traffic capacity assumption in the SES evacuation model obviously accounts for all the possible reasons for delays on the roads during any evacuation and also assumes a conservatively low traffic speed and capacity. This proposed Mirvac Planning Proposal does not intensify traffic in an evacuation as the number of vehicles involved from this site will be reduced from that which is currently consented under DA 611/2108, and further reinforced under a car parking cap in the Mirvac Planning Proposal. No allowances have been made for evacuees who travel to nearby friends and family or park in the local area and instead were conservatively assumed to continue on and utilise Nuwarra Road and other regional roads.

The SES's statements regarding traffic were previously refuted in Attachments A and B.
The SES's statement of: *"the vast majority of the area inundated by the Georges River PMF experiences a high hazard (….) for over 24 hours, in many places in excess of 40 hours. Therefore, failing to evacuate or deliberately sheltering in place in the Georges River floodplain is particularly risky considering buildings can be isolated and inaccessible to emergency services for more than 24 hours*" is misleading as the building does not become isolated until the 1 in 5,000yr flood and any trapped person can, as a last resort, safely shelter in place for the PMF period. The shelter in place would be **much shorter than the 24 hours that SES quotes,** because the floodwaters only have to recede back down to the 1 in 2000yr level for site access to be restored.

The SES themselves recount the 9/11 attack experience and then admit that egress was "multi-modal where many people walked out to get a ferry bus or train". We agree and yet we have been constrained to use the SES's traffic outdated model assigning every evacuee a vehicle, when this and other modern data say that the numbers of persons actually in residence and the numbers of vehicles and vehicle ownership that are used to evacuate are significantly lower.

2)SES: "Pedestrian and Rail Evacuation"

The pedestrian evacuation will be a backup strategy for those without a car or for should the car evacuation fail for any reason. The SES model for pedestrian flood evacuation has incorporated very conservative pedestrian walking rates to take account of density, weather, time of day, hazards, distances, etc. As well as the Moorebank Library, there are schools, shopping centres, hotels which are nearby to the Library which may be utilised as refuges in a rare flooding event. It should also be noted that the constructed pedestrian bridge across Brickmakers Drive has ramped access and has been designed to be accessible for use by wheel chairs.

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3) SES: "Addressing Risk to Life with Site Specific Emergency Planning

The SES note that they oppose the use of private flood evacuation plans. This development does not rely solely on a private flood evacuation plan however, the body corporate has a responsibility for the safety of all residents. As such, the body corporate will assist in any evacuation of the site based on an order from the SES to evacuate.

The SES suggests that flood evacuation plans should be updated regularly. This can be a Development Consent condition for the body corporate to prepare and report to Council annually (much like the Annual Fire Safety Statements). The body corporate has a legal responsibility to the well-being of the residents. This could not be done with Torrens Title developments and hence the Mirvac PP presents a significant improvement for management of residential development in floodplains, where appropriate.

The SES' claimed disadvantages of a site-specific flood evacuation plan are erroneous and are answered sequentially below:

- ***Power Outages***

  The building would have a backup generator power supply which would automatically start if there was a power outage. This would alleviate the need to fix the electrical system which would potentially cause more shortages with the potential to start fires. It also would alleviate the need for candles to provide light and potentially start fires;

- ***People do not heed evacuation advice with a private flood evacuation plan***

  This could also happen even in the SES door knock. On-site management have a much better understanding of each resident's needs and abilities and can communicate flood warnings and initiate evacuation in a more timely and individualised fashion than the SES. However, SES will control the evacuation with the assistance, as required, of the Strata Management;

- ***Flood warden not trained***

  We are not solely relying on a trained Strata Warden, although we will train them regardless. We are accepting that the SES-trained people will door knock in the proposed development. We do not have to rely upon the private flood evacuation plan to achieve a successful evacuation, but rather, it is intended that the processes work together and in collaboration.

- ***Conflicting information***

  We will rely upon the new SES website to verify flood and evacuation orders;

- ***Assumes immediate evacuation***

  This is not correct – the standard SES evacuation model was used to form the evacuation strategy for the proposed development which allows significant times for door knocking and actions by residents;

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- ***Assumes more than 12 hours warning time***

  This is the warning time until flood levels rise to RL 4 m AHD but the cutoff point for car evacuation is RL 5.6m AHD. Extra time is allowed beyond 12 hours for the car evacuation to account for the rise of flood waters from RL 4 to RL 5.6m AHD. Further time is added for the pedestrian evacuation to account for the rise of flood waters from RL 5.6m AHD to RL 7.2m AHD.

SES: "Managing Residual Risk"

We don't agree with SES's fundamental view that more people means more unacceptable risk. However, there will be less people in the proposed Planning Proposal development compared to the approved marina development under DA 611/2018 and therefore less risk.

Response to "SES Recommendations" summary:

Based upon the comments above, our comments on the SES recommendations are as follows:

"Recommend reconsidering the proposed residential development on the site"

The statements that the site is located on the "worst floodway" or in a "high risk" floodplain are not backed up by specific detail and justification and have been taken out of context from the Council minutes. This comment was specifically made in reference to the "the properties along Newbridge Road in Moorebank (@RL 2.0m AHD), which are located on one of the worst flood ways in NSW, are notified of risks of flooding via letters as part of the Moorebank Voluntary Acquisition Scheme". These properties are on land much lower than our site and within areas which are frequently flood affected and have little chance or time for evacuation of their sites. They are subject to very different flood constraints compared to the Mirvac Planning Proposal.

Additionally, we consider that the Molino Stewart report is seriously flawed in various ways as outlined in Attachments A and B and cannot be relied upon.

"Recommend that Georges River Flood Study 2020 (not adopted by Council) is used to determine the flood risk on the site"

We consider that the Molino Stewart report is seriously flawed in various ways as outlined in Attachments A and B and cannot be relied upon at this stage. Cardno has undertaken for the subject site a flood impact assessment for the Mirvac Planning Proposal. This site specific study is the preferred study because Cardno also undertook the flood impact assessment for the Benedict Marina which was approved by Council (DA 611/2018).

It is clear that SES doesn't understand that the Planning Proposal development ground floor is **2m above** the 1 in 100yr flood level and is not categorised as a "high flood risk" area. Any residents remaining in situ are still safe, and this is a commonly built solution around the world, Sydney, Moore Point and Parramatta CBD. Also, the Planning Proposal development can reduce the flood risk because the building platform and evacuation access is located at higher levels so that the development is able to readily conform to the conservative SES flood evacuation model.

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"Recommend seeking advice from the NSW Reconstruction Authority"

There is no justification as to why the proposed development should be reviewed by the Reconstruction Authority and the status of the Authority with regard to the planning process is yet to be known.

"Recommend careful consideration of the site to ensure that the proposed buildings are not subject to high hazard floodwater"

The building platform for the Planning Proposal is situated at the 1 in 5000 year flood level. Furthermore, Structural Engineers will design and certify the safety of the proposed building to flood debris and uplift forces due to all floods at the DA stage and this can be a Condition of Consent. This is a requirement for all development in flood prone areas of Sydney.

Similarly in reasoning is that apartment buildings are subject to *high fire risk* (and which are far more likely to occur in frequency than a 1 in 1.6 million years flood event) and yet the buildings are allowed to be constructed with appropriate measures.

"Recommend that any basement carpark is designed to be passively protected up to the PMF level"

The Planning Proposal proposes that the basement carpark **be watertight, not inundated and suffer no damage up to the 1 in 5000yr flood** at a level of RL 7.6m AHD which exceeds the requirement for the FPL (RL 6.1m AHD) as put forward by the *Independent Flood Inquiry*.

"Recommend further consideration of safety features…."

The design already ensures that flood waters up 1 in 5000yr levels do not enter lifts and people do not exit into flooded areas. Stairwells will be designed to allow access throughout the buildings during all flood level durations. The current planning proposal is intended to demonstrate that an apartment usage on the site is able to be facilitated, the apartment building themselves will be assessed at the development application stage and this is where all safety features will be designed and approved.

"Recommendation ensuring that any proposed plant rooms, service rooms, and waste storage are located above the PMF level"

The design will locate plant and essential services above the 1 in 5000yr flood at RL 7.6m AHD and a generator so as to maintain emergency power above the 1 in 1.6 million/yr (PMF) level.

In summary, we believe that the proposed Mirvac PP development has been appropriately designed so as to acceptably deal with all flood risks without placing an undue burden on emergency services and should be supported by the Department of Planning, noting that it is enthusiastically supported by the local community.

Mark Tooker
Director
Tooker and Associates

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ATTACHMENT A
Tooker and Associates
Review of the Molino Stewart Flood Evacuation Report
16 June 2022

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TOOKER+ ASSOCIATES

Liverpool City Council
Attn: Cameron Jewell
ostel@liverpool.nsw.gov.au

16 June 2022

JewellC@liverpool.nsw.gov.au

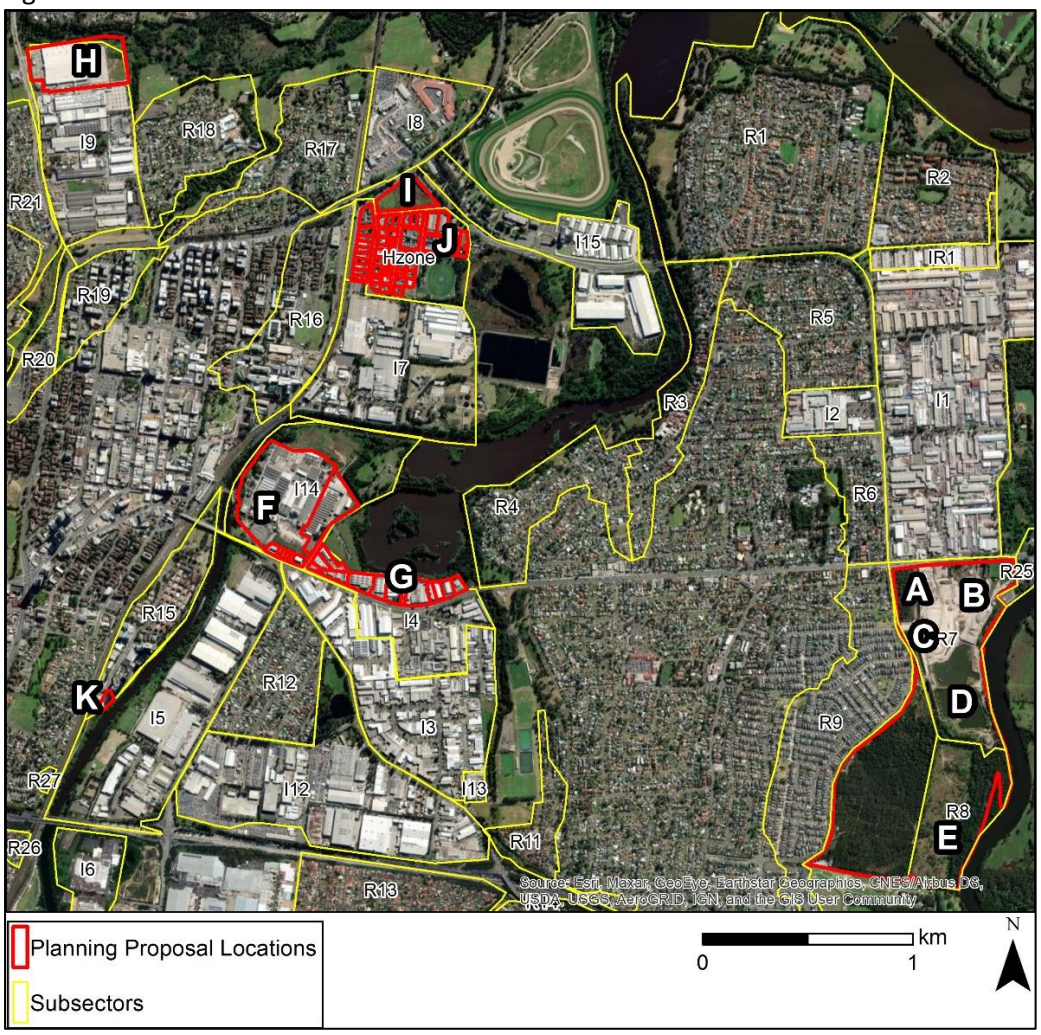
Dear Sir,

Re: Review of Georges River Evacuation Modelling, Flood Evacuation Analysis Draft, December 2021, Molino Stewart – Mirvac Review

With reference to your email dated 17 December 2021, we are pleased to provide an initial response to the above Molino Stewart report on behalf of Mirvac who are the developer for sites C and D in the Moorebank East precinct (see Figure 1).

This report has been created to bring attention to the assumptions made in the Molino Stewart Report and model that are either incorrect, incorrectly applied or create an unrealistically conservative outcome when combined with other overly conservative assumptions in the same model that ultimately impacts the development capacity for the Moorebank East area.

Figure 1



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1. Site Description

The Mirvac sites C and D are located in region R7 in Figure 13 of the Molino Stewart report.

The sites are generally known as follows:

- Site C – Mirvac residential development referred to as Moorebank Cove in the Molino Stewart report (under construction {DA-24/2017});
- Site D – Mirvac marina development (marina approved (DA-611/2018) with Mirvac Planning Proposal for residential development on top (RZ-5/2018) – well supported by Council).

The proposed development details included in the Molino Stewart report are summarised in the following Table 1.

Table 1. Proposed Moorebank East Developments

Site	Development Type	Commercial Space (ha)	Employees	Dwellings	
				Houses	Apartments
Site A: Tanlane P/L(Benedict)	B6 Mixed use	0.89	857	0	126
Site B: Flower Power	Mixed use and commercial strip	2.32	361	0	602
Site C: Mirvac Moorebank Cove	Low density residential	0	N/A	179	0
Site D: Mirvac Georges Cove Marina	Apartments Restaurants Marina services	1	N/A	21	374
Site E: EQ Riverside	Apartments and commercial/ retail	0.18	207	0	1,500

2. Approved Evacuation Strategy

The evacuation strategy approved by Council for the three Benedict/Mirvac sites A, C and D is as follows:

a. Car evacuation;
b. Pedestrian evacuation in case of failed car evacuation;
c. Shelter in Place above the PMF.

An overhead pedestrian bridge over Brickmakers Drive has been approved by Council as part of the Site C (Mirvac Resi) development (under DA-24/2017) which has capacity and access for all the Benedict/Mirvac developments including Sites A, C and D. This provides pedestrian access to land above the PMF level for evacuation if the vehicle evacuation fails. The developments all have many floor levels above the PMF level suitable for the tertiary evacuation option (shelter in place) if the first two strategies fail.

The Moorebank Cove (Site C) approval under DA-24/2017 also includes a Flood Emergency Response Plan (FERP) that outlines the flood evacuation strategy and hierarchy noted above, notes the

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evacuation routes and flood signage, and notes the role of the Community Manager (under the Community Title structure) in flood evacuation training and evacuation assistance.

A similar FERP would be formulated for the developments on Sites A and D that would also be managed through Strata and Building managers.

So, all the Benedict/Mirvac sites within the Moorebank East precinct have legitimate flood evacuation strategies which conform with the SES guidelines.

3. Response to Molino Stewart Draft Evacuation Strategy

The consideration of the Mirvac Planning Proposal for site D (Marina) is well advanced and supported by Council compared to other sites (Flower Power and EQ Riverside) in the Moorebank East precinct. The Mirvac Residential development on Site C has already been approved under DA 24/2017 and is well under construction. These sites add a comparatively small increase in vehicle numbers compared to the proposed Flower Power and EQ sites in the precinct.

Most importantly, these sites (Sites A, C & D) have a multi-faceted evacuation strategy which conform to the SES guidelines.

Molino Stewart makes a reference in Section 7.2.5 to the need for a pedestrian evacuation route in case vehicular evacuation failed when referring to the Moorebank East precinct. We note that this route has already been approved for the Benedict/Mirvac sites by Council under DA-24/2017 (refer below) and is soon to be under construction.

3.1 Development in Areas C and D should be included in Scenario 2 (Infill development)

The freestanding residential development in Area C was rezoned in 2008 and the DA was approved via DA-24/2017 in 2020. The marina development on Area D is an allowable development for the existing zoning and a DA was recently approved (DA-611/2018). As such, these developments should be included in Scenario 2 which includes infill development between 2016 and 2036. These developments offer the three levels of emergency response to the PMF flood as required by SES. The primary response is evacuation by car, the secondary response is an approved pedestrian access route to flood free land and the third response is to shelter in place at levels above the PMF flood. The development in these areas has been approved by Council and should not be part of Scenario 3 which examines existing Planning Proposals.

3.2 Unrealistically conservative, cumulative assumptions adopted in evacuation modelling

a. Road capacities

The maximum lane capacity adopted in the Molino Stewart (MS) modelling traffic evacuation model should not be 600cars/hr/lane but the normal rate of 1200 to 1400cars/hr/lane (say 1400cars/hr/lane).

The SES recommend in their simple evacuation model (TEM) a maximum car capacity of 600cars/hr/lane. This model has no way of accommodating influences such as road congestion, merging or intersections. This rate was selected as a general rule to take account of all these influences. However, these influences vary considerably depending on the road layout and configuration and as such, is a broad generalization.

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During the early stages of the evacuation, and especially for those strata and community titled developments which will receive an early electronic evacuation warning, the local road capacities may be much higher than 600cars/hr/lane. Furthermore, the capacities of the major multi lane roads could be significantly higher than 600cars/hr/lane.

The model adopted by MS (LSM) uses traffic modelling which is able to model these influences and derive every changing road capacity specific to each site. As such, MS do not need to use the SES 600cars/hr/lane as the maximum road capacity in all circumstances because the model can assess the degree of changes in road capacity for every time step in the model. Therefore, the maximum lane capacity adopted in the MS LSM model should be 1400cars/hr/lane and the model will determine the actual capacity at every time step.

In Scenario 2, there are only 399 vehicles trapped on the Moorebank Peninsula. This could be readily solved by not limiting the maximum road capacity to 600cars/hr/lane when the model determines the maximum road capacity rate which could be as high as 1400cars/hr/lane.

b. Full capacity at work and home

The duration of the evacuation will be at least 12 hours and has a high probability it will overlap to some extent with the non work hours. Assuming full capacity of the numbers of people to be evacuated is unrealistic and requires a more realistic assessment.

Some of the possible reasons why full capacities would not occur for evacuation are:

- People are on holidays outside the area;
- Flood warnings are given in non work hours and people do not travel into the area for work;
- People who evacuate to local friends and family or to friends and family not located on selected evacuation routes;
- People on the edge of the PMF zone who do not evacuate;
- Increased use of public transport since the travel to work surveys used in the study for people travelling from areas outside; and
- Two car households only using one car for evacuation or multiple car households not using all cars for evacuation.

c. Warning times

The SES evacuation approach is that door knocking is required to initiate flood evacuation. The SES assumes that it will take 6 hours to mobilise people to undertake door knocking. This 6 hours is half the minimum warning time for the Moorebank Peninsula. This may be necessary for standalone residential areas however, for strata and community titled developments and work places, an electronic warning to the management with associated alarms could be sent instantaneously to initiate evacuation and provide at least 12 hours warning.

For every saving of 1.5 hours until evacuation is initiated, this would allow extra capacity of say an extra 900 cars at 600cars/hr/lane or extra 2100 cars at 1400cars/hr/lane. This means of evacuation initiation is unlikely to be affected by power outages as flood levels would not be anywhere near critical at that stage. This means that strata and community type developments (which have flood evacuation plans and training incorporated in their strata and community documents) could take advantage of the early capacity availability on local roads. Door knocking would still have to be done

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for stand alone Torrens Title residences in areas outside of the Moorebank East developments impacted by the PMF.

The warning times will be longer than 12 hours for these types of developments with electronic warnings. The 12 hours warning is for floods to reach RL 4m AHD. A further 1.5hrs warning time would be available to many areas prior to flood levels reaching evacuation tripping points/levels. This could allow up to a further 2100 (at 1400/hr/lane) vehicles to evacuate in the early stages of the evacuation.

d. Rate of flood level rise

Again, the rate of flood water rise adopted is the absolute worst case which when added to all the other very conservative assumptions, you end up with a very unrealistic presentation of risk.

In Section 5.3 Applying the Life Safety Model to the Georges River in the MS study it is asserted, in part that:

> *While it is recognised that this is an extremely rare event, more frequent events could rise this quickly ….*

This is not correct. A comparison of the rate of rise of the 36 hour Extreme Flood Event (EFE) and 100 yr ARI flood is given in Figure 2 on the next page. This indicates that more frequent events are not as likely to rise at the rate of the EFE. There is a stark difference in the rate of rise for the 100 year ARI flood which takes 16 hours to achieve any similar rate of rise as for the PMF type flood as demonstrated in Figure 2 below. This would provide a significantly longer flood warning time and greatly increased capacity for evacuating vehicles from the area.

3.3 Area D – Marina and Mirvac Planning Proposal

The Benedict marina development approved recently by Council (DA-611/2018) should be included in Scenario 2 as discussed in point 3.1 above. The marina has parking for 637 vehicles to support the marina and recreational uses. The Mirvac Planning Proposal for this site (RZ-5/2018) incorporates 624 parking spaces which is 13 less parking spaces on the already approved marina allowance. These less number of vehicles for the Mirvac Planning Proposal need no extra time for flood evacuation than is already approved by Council for the Benedict marina development. This could be readily achieved given that evacuation for this development will not rely on door knocking and can be initiated electronically for this strata/commercial development.

The Mirvac Planning Proposal has no adverse impact on the flood evacuation capacity compared to already approved developments and could be readily included in Scenario 2 given the cumulative conservative nature of all the evacuation model assumptions. As mentioned in point 3.2a above, in Scenario 2, only 399 vehicles would be trapped on the Moorebank Peninsula. The Mirvac Area D Planning Proposal does not add any extra time for flood evacuation as it would add less cars on the road for a flood evacuation compared with the already Council approved Benedict marina development. The 399 vehicles supposedly trapped on the Moorebank Peninsula is a very small number given the leeway available in the very conservative assumptions in the evacuation model. These vehicles could be accounted for with a small increase in warning time and/or a small increase in design road capacity.

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The evacuation modelling shows that use of multiple evacuation routes significantly improves evacuation and tends to reduce interference between the two main areas of Moore Point and Moorebank Peninsula. There is also significant potential for resident evacuation in the future

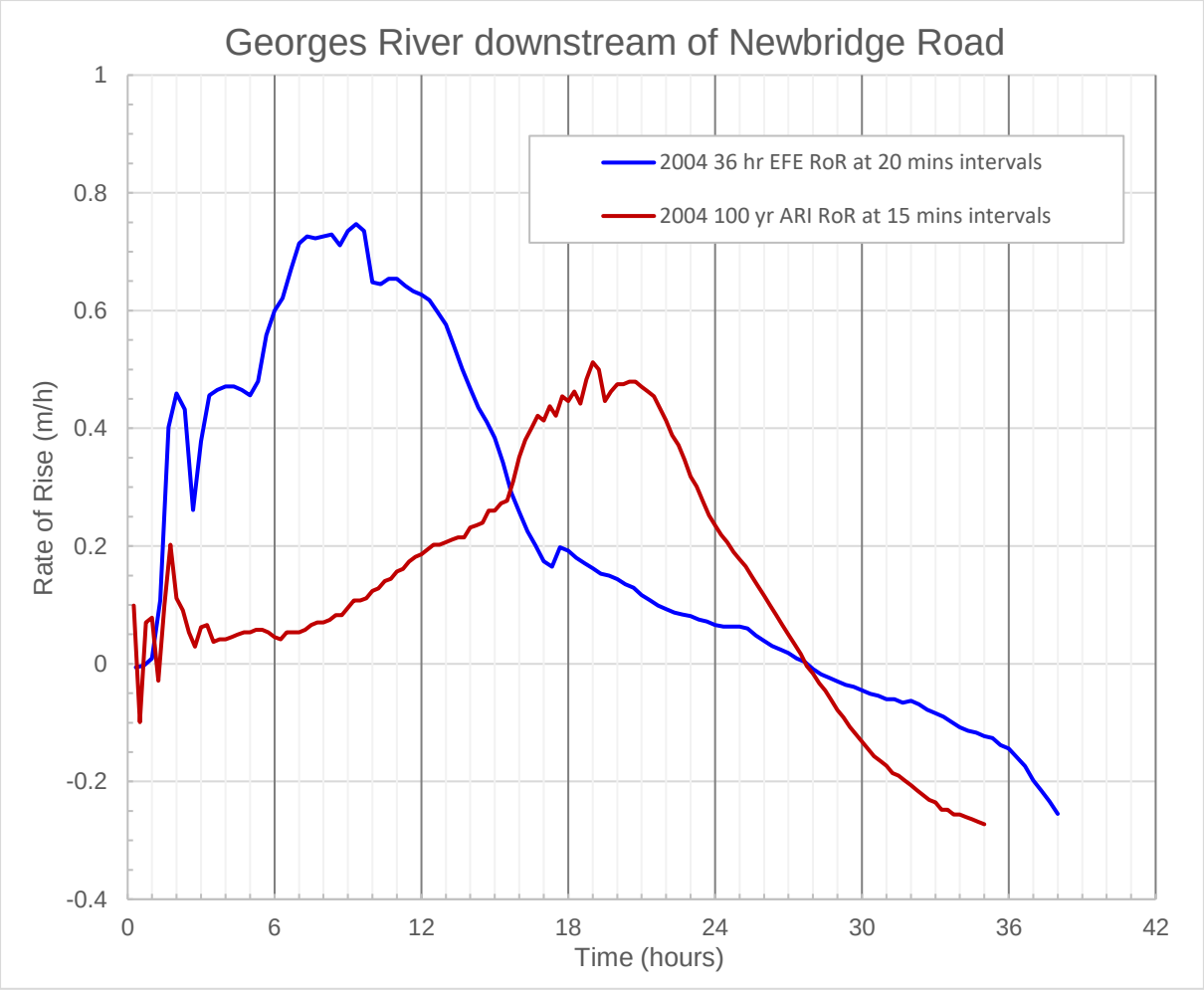

Figure 2 Rates of Rise in floodwaters downstream of Newbridge Road

Liverpool CBD as is occurring in the Parramatta CBD with increasing provision of apartments above the PMF flood levels.

3.4 Three Stages of Evacuation

The Molino Stewart report, in many locations, emphasises the SES requirement for a three stage evacuation capability. The approved developments on Areas A, C and D have these three stages of evacuation available to the residents. These three stages of evacuation would also be available for the Planning Proposal development at the Marina in Area D.

These three stages include vehicular evacuation, pedestrian evacuation and shelter in place with floor levels above the PMF level.

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The sole focus of the Molino Stewart 2022 study is vehicular evacuation to undisclosed locations remote to the floodplain. This ignores the potential for a number of safe refuge areas (as noted in 4.3.1 of the MS report) at local public properties and commercial properties to provide parking for vehicles and facilities to provide temporary refuge to local residents forced to evacuate. For the Moorebank East area, these possible locations around Nuwara Rd could include:

- Moorebank Library
- Moorebank Shopping Centre
- Moorebank Hotel
- Nuwurra Public School
- Moorebank High School
- Newbridge Heights Public School
- Hammonvile Public School
- St Joseph's Primary School
- St Joseph's Church

The utilization of these facilities in situations of an extreme flood (far rarer than a 100 yr ARI flood) would be expected to reduce the need for vehicular evacuation to regional refuge sites. Also, there would be those workers who live outside the local area and those residents who would still want to evacuate to friends and family living elsewhere in Sydney which would further reduce the vehicular evacuation to the regional refuge locations.

3.5 Factual Flood Information

3.5.1 Flood Gauges and warning times

In Section 4.3.5 of the MS report:

Table 7 appears to be in error. The Milperra Gauge is not in the Sutherland LGA rather it is located in Canterbury-Bankstown LGA.

Reported levels in Table 8 appear to be incorrect. The 1% AEP (100yr ARI) flood level at Milperra Gauge is around 6.0 m AHD (6.5 m gauge reading) not 9.1 m.

The MS report indicates that the flood warning time is based on flood levels reported from the Liverpool and Milperra flood gauges and if these are damaged or malfunction in a flood, then the warning time may be less than 12 hours. However, this is incorrect. The extreme flood warning is provided by BoM and they rely upon modelling of forecast rainfall and do not rely on flood gauge readings. This is why they can provide a minimum of 12 hours flood warning before there are noticeable rises in the flood level at the gauges. Damage or malfunction of flood gauges is not a potential risk to reduce the 12 hour minimum flood warning time.

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3.5.2 2020 Flood Study

The key study and information includes, in part:

- Georges River Flood Study 2020 2D TUFLOW model for flood behaviour information and flood impact probabilities

It is noted that this study is not in the public domain which precludes a review of the adopted PMF time series or any other flood related behaviour within the study area.

Given past practices, it is expected that the 2020 Georges River Flood Study has adopted the 2004 Georges River Floodplain Risk Management Study inflows which in turn were estimated in the 1991 Georges River Flood Study.

In relation to the Probable Maximum Flood, it appears that the 2022 Evacuation Modelling is relying on an Extreme Flood Estimate which is more than 30 years old and the accuracy of which has not been confirmed by assessing the PMF in accordance with current practice as outlined above.

The likely occurrence of the PMP flood recommended by ARR2019 for the Georges River based on the catchment area to East Hills is around 1 in 1,600,000 AEP. This evacuation assessment is based on a very rare event which is likely to occur once in 1.6 million years (first homo erectus occurs in Asia 1.6 million years ago) or once in 21,333 generations (75 years each).

To illustrate this in other words, the likelihood that residents and workers located within the PMF flood extent within the study area would experience a PMF, the probability of residents and workers experiencing a 1 in 100 AEP (100 yr ARI) flood in a 100 year period is 63.4%. The workers and residents and their descendants would need to reside on the floodplain for 1,600,000 years (21,333 generations based on an average generation life of 75 years) in order to have the same probability of experiencing the PMF ie. 63.2%.

The risks in terms of evacuation are further exaggerated in the Molino Stewart study due to very conservative assumptions with respect to road capacities, availability of roads, numbers of vehicles and availability of alternative refuges.

4. Conclusions

The approved developments in Areas C and D and the Mirvac Planning Proposal for Area D (marina) have been dealt with unfairly by not being included in Scenario 2. Both developments are able to comply with the SES three stage evacuation strategy and should be included in Scenario 2.

There has also been no realistic consideration of the results for the Moorebank Peninsula in that the trapping of 399 vehicles for Scenario 2 is a minor problem when you consider the worst of the worst assumptions included in the evacuation model. There could be no trapped vehicles with small variations to assumptions such as road capacities. These 399 vehicles could be accommodated in 20 minutes with a road capacity of 1400cars/lane/hr. The Mirvac Planning Proposal for Site D (which would replace the already approved Benedict marina) would not add any further cars to the evacuation than for the already approved number of cars in the Benedict marina development.

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Models are as only as good as their assumptions and experienced flood modelling expertise needs to be applied to the results in order to assess the realistic flood risks. We need to appropriately manage risks so that the costs to society for flood evacuation is balanced with our approach to risk to life in all other areas of society. This will provide surety and the least risk during severe floods in the Georges River.

This evacuation assessment is based on a very rare event which is likely to occur once in 1.6 million years (first homo erectus occurs in Asia 1.6 million years ago) or once in 21,333 generations (75 years each) however, the risks in terms of evacuation are further exaggerated due to very conservative assumptions with respect to road capacities, availability of roads, numbers of vehicles and availability of alternative refuges.

These assumptions with respect to already approved developments and the Mirvac Planning Proposal for Site D need to be reviewed particularly in terms of road capacities and longer available flood warning times for strata/community developments so that the adoption of worst cases for all these factors does not occur because it distorts the actual risks and will place an unrealistic and unaffordable burden on development.

The MS study needs to be revised as required in this letter and further information is required to clarify the errors or mis statements in the report. Based on this study and in terms of flood risk, there is no technical reason why Council could not approve the Mirvac Planning Proposal for Site D.

It would be appreciated if Mirvac representatives could meet with Council and Molino Stewart to discuss our above concerns to find a realistic way forward for the Mirvac Planning Proposal at Site D.

Yours sincerely

Mark Tooker
Director

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ATTACHMENT B
Risk-e Business Consultants
Review of the Molino Stewart flood Evacuation Report
16 June 2022

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GEORGES COVE MARINA - MOOREBANK

MIRVAC DEVELOPMENT

Risk-e Business Consultants Pty Ltd

Table of Contents

Executive Summary

Risk-e Business Consultants Pty Ltd was requested to review documentation that was provided to Liverpool City Council, including the Molino Stewart Flood Report and link the information to sound research and analysis to provide a more accurate picture of the proposed development that considers all aspects of the present and future development and NSW SES evacuation information.

The Reports and documents have been reviewed by Mr Dave Owens APM (CV attached) and Mr Pat Paroz APM. Mr Owens and Paroz are both subject matter experts on flooding and evacuation management. Mr Owens has been accepted by the NSW Coroners Court as a Subject Matter Expert in Emergency Management and holds two master's Degrees in this area. He has also provided numerous report and reviews on emergency management and combat agency response. Mr Owens & Paroz co-developed the current version of the Hawkesbury Nepean Valley Flood Plan on behalf of the NSW SES.

There are a number of inconsistencies within the Molino Stewart Report identified within our review that are covered in the body of the document. These have been placed together under the headings of:

- Phased approach to evacuation management
- Vehicle capacity per lane during evacuation
- Proposed Evacuation Strategy
- Assuming full capacity of residents and/or workers requiring evacuation
- Assuming a 100% evacuation warning compliance rate
- Evacuation route modelling not taking into consideration local evacuation centre in Liverpool
- Warning times

It is our recommendation, that using this information, that Mirvac Development is now in a position to write to Liverpool City Council outlining the considerable concerns with the Molino Stewart Report which is based on the assumptions provided by the NSW SES. The information provided by us should accompany the letter as a technical addendum to support Mirvac's request for development approval.

David Owens APM
Managing Director
Risk-e Business Consultants
16 June 2022

Pat Paroz APM
Senior Consultant
Risk-e Business Consultants
16 June 2022

Background

The Georges Cove Residences is a low-density Community Title development consisting of 179 Mirvac built homes, community facilities and parks. The development application for this site has been approved and homes are already under construction.

The Georges Cove Marina (Benedict) development application has been granted and allows for construction and operation of the commercial Marina which includes the approval of 637 associated car parking spaces. An alternate (Mirvac) planning approval is being pursued for the same site for a residential development of 21 homes and 374 apartments with fewer car spaces.

Liverpool City Council has approved an evacuation strategy for these sites which involves:

- Car evacuation as the primary strategy
- Pedestrian evacuation in case of failed car evacuation
- Shelter in Place above the PMF.

The staged or phased approach to evacuation conforms with the NSW SES evacuation guidelines.

An overhead pedestrian bridge over Brickmakers Drive has been approved by Liverpool City Council as part of the Georges Cove development. There is easy pedestrian access to this bridge from the Georges Cove Marina, Mirvac residential (being built) and Village developments. The bridge provides pedestrian access to land above the PMF level for evacuation if the vehicle evacuation fails, or if pedestrian evacuation is sought early in the phased approach to evacuation. We would recommend the optionality of a combination of pedestrian and vehicle evacuation in the early stages of evacuation.

Where vehicular and pedestrian options have not been taken by residents, safe refuge can be found on site as the developments **all** have many floor levels above the PMF level suitable for the tertiary evacuation option (shelter in place).

In relation to the approved car parking spaces, we make the observation that during a usually prolonged weather event that is likely to lead to a flooding emergency, it is highly unlikely that the Marina would be in operation and/or customers would be using the facility. This has not been considered in the Molino Stewart Report and should be.

NSW SES – Not legislated authority on flood planning development

Unlike the NSW Rural Fire Service in bushfires, the NSW SES is not legislated as the authority for flood planning development. Currently, the NSW SES is **providing advice** in a process where its representatives are **not subject matter experts.** The resources and expertise of the NSW SES in this area is limited as demonstrated by its inability to maintain up-to-date flood Sub Plans including the Hawkesbury-Nepean Valley Flood Plan. This demonstrated by the fact that NSW SES required an external

organisation be engaged to undertake this task (being our organisation Risk-e Business Consultants).

The NSW State Flood Plan states:

> *NSW SES will work with land use planning and consent authorities to inform and influence the consideration of the risks arising from flood, storm and tsunami, **to prevent the creation of intolerable impacts** of these hazards on the community*

NSW SES-Basing evacuation modelling on outdated or incomplete Flood Sub Plans

The evacuation modelling undertaken for the Georges Cove Marina and surrounding areas relies entirely on the 2018 Sub Plan, of which Volumes 2 and 3 were incomplete (and still remain incomplete). Volumes 2 and 3 of the Liverpool Sub Plan are important to any evacuation analysis as they contain the "triggers" for emergency response actions/evacuation. Therefore, the evacuation modelling is based on outdated data in what is a dynamic and rapidly growing area. The NSW State Flood Plan clearly articulates that it is the responsibility of the NSW SES to maintain these plans. The Molino Stewart Report acknowledges this fact, yet this has not occurred, leading to inaccurate outcomes.

Vehicle capacity per lane during evacuation

The NSW SES Timeline Evacuation Model for estimating traffic movement 'does not attempt to dynamically model traffic demand for flow rates. The purpose of the model is to produce a best estimate of how much time is expected to be needed for traffic clearance from the area being evacuated'.

The assumption used for the purposes of the Molino Stewart Report by the NSW SES is based on an average flow of 600 vehicles/lane/hour. This figure is *'derived from a **typical rural road design flow** (our emphasis) rate of 1200 vehicles/lane/hour, downrated by a factor of two to account for the adverse driving conditions such as heavy rain, darkness and driver unfamiliarity that will probably prevail in a flood.*'[1]

The roads in the vicinity of the proposed developments (Moorebank East) do not include 'typical rural' roads. Much of the roadworks used in any evacuation routes are or will be newly constructed urban roadways which link with motorways (M5 and M7) and major arterial roads such as Newbridge Road and Heathcote Road.

According to the NSW Roads and Maritime Service[2], the operational capacity for basic motorway segments on an unmanaged motorway (where all or some motorway entries are not controlled by ramp metering), is 1800 vehicles/lane/hour. This is reduced to 1640 vehicles/lane/hour to allow for the inclusion of 10% of trucks and other commercial vehicles in the traffic flow. The separated lanes of traffic on these major roads and motorways 'will also increase per-lane capacity when compared to a single

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[1] *The Application of Timelines to Evacuation Planning* (2004). Steve Opper, State Planning Coordinator, NSW SES.

[2] Motorway Design Guide – *Capacity and Flow Analysis* (2017)

carriageway'[3]. The 'typical rural road design' referred to by the NSW SES and used in their modelling is highly unlikely to include divided roadways.

Austroads is the collective of the Australian and New Zealand transport agencies, representing all levels of government. The organisation provides 'high-quality, practical and impartial advice, information, tools and services to help our members to deliver efficient, reliable and safe mobility to their customers'.

Austroads[4] advises that '*peak flow capacity of a freeway with a speed limit of 100 km/h is 2300 vehicles/lane/hour and that there are a number of factors which can affect this capacity*.' These factors include:

- Road functionality
- Land width
- Terrain
- Human behaviour

The driver population can have a significant impact on traffic capacity. Local knowledge and regular use of a road network is a protective factor, whereas '*where weekend or recreation drivers are a significant portion of the traffic stream, the capacity may be reduced*'[5]. This is not the case with the development proposal.

We submit that this is particularly relevant to the NSW SES Timeline Evacuation Model, based as it is on the traffic capacity of a **rural road.** It is more likely that a rural road will have less frequent users and this may have an adverse impact on traffic capacity, thus supporting the reduction in capacity to 600 vehicles/lane/hour.

However, the same cannot be said for the road network in and around the proposed development. These roads will be used predominantly by residents and/or workers on a daily basis. They will be familiar with the roads and local traffic issues and their presence alone is highly unlikely to contribute to reduced traffic capacity.

There is a need to consider and model higher road usage during evacuations (900 vehicles per lane per hour). Currently Molino Stewart is using a blanket approach to all roads and does not consider the advanced city infrastructure that accompanies this proposed development.

It is noted that there appears to be some confusion as to the origin of the 600 vehicles/lane/hour figure. The definition used above is taken from a document prepared by Steve Opper in his role as NSW SES State Planning Coordinator[6] (February 2004). In a report dated 2011[7], the authors (all employees of the NSW SES), state that '*The figure of 600 vehicles/lane/hour was not developed by the SES. It has*

[3] VicRoads Managed Motorway Design Guide, Volume 2 Part 1, page 29.
[4] www.austroads.com.au *Austroads Traffic Analysis Concepts*. Accessed 8/6/22
[5] www.austroads.com.au *Austroads Guide to Traffic Management* – Part 3, page 36. Accessed 9/6/22
[6] *The Application of Timelines to Evacuation Planning* (2004). Steve Opper, State Planning Coordinator, NSW SES.
[7] *Timeline modelling of flood evacuation operations* (2011). Stephen Opper, Peter Cinque & Belinda Davies. NSW SES

been adopted based on similar numbers quoted in other sources such as military convoy planning.' For a factor as important as the acceptable traffic capacity for flood modelling, this matter should be clarified. There is no NSW SES Policy or peer reviewed research that support this assumption.

Proposed Evacuation Strategy

Liverpool City Council has approved an evacuation strategy for the three Benedict/Mirvac sites A, C and D. The evacuation strategy involves a multi-layered approach based on primary evacuation by vehicle (*for those residents who own a vehicle*), with a secondary option being pedestrian evacuation (via the approved pedestrian bridge which provides a safe walking route from the site to Paine Park). Additionally, the developments all have buildings with many floor levels above the PMF which will be safe for those residents who refuse to leave or decide to leave after it is too late.

This approach to an evacuation strategy is in accordance with the 2021 NSW SES Liverpool City Flood Emergency Sub Plan – Volume 1, which states, in part:

- Evacuation is the NSW SES's primary response strategy for managing the population at risk of flooding (section 5.8.1), and
- People who are reluctant or refuse to comply with any Evacuation Order will be referred to the NSW Police Force (section 5.8.4).

While **vehicular evacuation is historically** the preferred primary response to a major flood, changes over time in relation to vehicle ownership make **it essential that pedestrian evacuation is included as a phased approach to evacuation.** Phased evacuation is a strategy used in either total or partial evacuation when, due to the slow onset of a hazard or to avoid congestion on roads, affected communities are encouraged or directed to evacuate at different times[8].

We recommend that a phased approach to evacuation is adopted in these circumstances where pedestrian, vehicular and shelter in place are all considered in the modelling process.

The Molino Stewart Report (March 2022) includes the comment that '*while the NSW SES evacuation planning for the Georges River relies upon motor vehicle evacuation, there are currently thousands of people within the floodplain that do not have access to a vehicle (over 30% of dwellings in some areas).*'[9] The same report also states that '***it is emphasised that the modelling is only as good as the model's inputs and assumptions'***. This is further supported by ABS census data for the Liverpool LGA that **17% of the population don't own motor vehicles**, and therefore would not be able to evacuate in the manner assumed by Molino Stewart and steadfastly stipulated

[8] Australian Disaster Resilience Handbook collection – Evacuation Planning (2017)

[9] Molino Stewart – Georges River Evacuation Modelling. *Flood Evacuation Analysis*. Final. March 2022.

by the NSW SES[10]. This highlights again that due to poor assumptions provided to Molino Stewart by the NSW SES, a less than accurate report has been produced.

Another *Austroads* report[11] refers to *Mobility as a Service (MaaS),* describing it as '*a shift away from personally owned modes of transportation and towards mobility solutions that are provided as an on-demand service. Examples of MaaS in recent years includes the growing popularity of Uber or Ride Sharing applications which has transformed the transport industry away from traditional taxis and reduced the need to own a car.*' This is reflected in the increasing number of households where residents do not have their own vehicles. **This highlights that the NSW SES appears to be out of touch with the realities of urban living** in a city that must/should be designed to cater for future population growth, based on the modes of transport that the growing population is adopting (alternates to vehicular transport).

The same report (page 25) also refers to 'active transport', which typically refers to walking and cycling. The report states that '*for future planning and investment decisions, it is important that active transport modes are duly considered as another element of the transport network and assessed accordingly.*' We submit that the same consideration needs to be given to active transport, particularly pedestrians, when planning for evacuations.

It is acknowledged that the NSW SES generally does not support pedestrian evacuation – but with increasing numbers of residents not owning motor vehicles, we submit that this option must necessarily be included in any suite of evacuation strategies (**phased approach to evacuation**). If the Evacuation Timeline Model is to accurately include relevant factors, then the likelihood of pedestrian evacuation must be included as a factor.

'Shelter in Place' is not supported by the NSW SES **as a primary evacuation strategy**. However, given all the variables involved in the evacuation process, **the most notable being human behaviour,** the capacity for people to seek refuge in appropriately designed and constructed buildings with provision of adequate space above the PMF, is becoming increasingly relevant.

A Victorian SES submission to an Inquiry into Flood Mitigation Infrastructure in Victoria (2011) stated, in part, 'Recent work by NSW and Victoria SES's (*Community Safety Decision Making in Flash Flood Environments* – Presented at FMA Conference Tamworth 2011) has produced a draft evidence-based guideline to assist planners and incident controllers to make appropriate planning and operational decisions for flash flood environments. This guideline recognizes evacuation as a primary strategy where possible, however also examines the safety of building occupants if they become trapped by fast rising flood waters and recommends that if such cases arise building occupants should seek shelter in the highest section of their building and if necessary, call '000' if emergency rescue is required'.

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[10] ABS census data https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC12361?opendocument

[11] Austroads – *Management of Traffic Modelling Processes and Applications,* page 24. (2021)

The Australasian Fire and Emergency Service Authorities Council Limited, developed a guideline for the Emergency Planning and Response to Protect Life in Flash Flood Events (2018). This guideline was developed based on research carried out by NSW SES that investigated risk to life factors in flash flood environments, and operational experience.

The guideline states, in part, '*Because of the rapid onset of flash flooding and associated high-velocity floodwaters, up to* ***75% of flash flood deaths occur while people are outside buildings attempting to leave or return****, and directly exposed to floodwater. This suggests that if evacuation has not occurred prior to the arrival of floodwater, taking refuge inside a building may generally be safer than trying to escape by entering the floodwater.*'

The above advice is reflected in a message on the NSW SES website:

'*When flash flooding is likely, leaving low-lying homes and businesses (evacuation) well before flash flooding begins is the best action to take, but only if it is safe to do so. If you are trapped by rising floodwater, seek refuge in the highest part of a sturdy building.'*

While this advice refers to 'flash flooding' (defined in Australia as flooding occurring within six hours of heavy rainfall that causes it), we submit that it supports the inclusion of residents sheltering in place as a legitimate option in support of the primary strategies of vehicle and/or pedestrian evacuation.

The applicant's proposal does not suggest that sheltering in place be the primary flood emergency response. Rather, it is a final option available to persons where both vehicular and pedestrian evacuation options have failed or not been attempted. However, if done correctly it is a safe option that needs to be considered and factored into any phased evacuation model.

It is also highlighted that within the Parramatta City CBD, Shelter in Place has been accepted as an evacuation strategy by the NSW SES and Parramatta City Council.

Assuming full capacity of residents and/or workers requiring evacuation

The 2016 Census (2021 Census data not available at time of writing this report) indicates that just over 90% of the residents of the Moorebank suburb travel to work by vehicle (as driver or passenger 76.6%) or public transport (13.8%). The 2011 Census indicates that approximately 80% of Moorebank residents travelled to work.

In the event of a flood warning, it is highly likely that many of these persons would already be away from their residence and their evacuation would therefore not need to be included in terms of traffic capacity.

The 2016 Census also revealed that 5.2% of dwellings in the suburb of Moorebank were unoccupied on the night the census was conducted. The 2011 Census revealed that 4.8% of dwellings were unoccupied.

The proportion of unoccupied dwellings (5% on average across the 2011 and 2016 Census data) therefore, should be factored into any evacuation modelling. Molino Stewart did not do this.

Further, given the large proportion of residents who travel to work by vehicle or public transport, it is likely that many of these people will be away from their residence when/if an evacuation warning is delivered and the vehicle cannot be used for the purposes of evacuation as stipulated by the NSW SES.

Assuming a 100% evacuation warning compliance rate

While acknowledging the NSW SES planning for the evacuation of all flood affected residents, evidence from operational responses clearly indicate that a 100% compliance rate is extremely unlikely.

The March 2022 Molino Stewart report (page 74), referring to post-flood surveys undertaken for the NSW and Victorian SES, suggest that the '*vast majority of residents do not evacuate at all when ordered to do so.* ***Most would probably await the arrival of floodwaters at their doorstep before leaving*** *and then it would be too late for vehicular evacuation and, for those who get isolated by floodwaters, too late for pedestrian evacuation'*.

Elsewhere in the same report (page 33), reference is made to research which shows:

- Less than 25% of people evacuate when told to do so
- About 10-20% of people say they will not evacuate under any circumstances.

A blanket policy of evacuation of all buildings is not feasible or realistic. Experience shows that residents are unwilling to evacuate even when instructed to do so. This is the position put in a report titled, *Update of Parramatta Floodplain Risk Management Plans* (*in draft*), where Molino Stewart state:

a) *Residents have demonstrated an unwillingness to evacuate when orders have been given to evacuate in floods throughout Australia in recent years, so it may be especially difficult to get people to leave an elevated dwelling in a high rise building on foot in torrential rain.*
b) *Residents will tend to remain in their dwellings for several hours or more even if they are without services such as electricity.*

In a paper[12] prepared for the Australian and New Zealand Disaster and Emergency Management Conference (2014), the authors wrote, in relation to the Flood Evacuation Timeline Model, that '*the guideline for the use of the FETM tool makes it clear that some, or all, of the evacuees may be unable, or unwilling to evacuate by motor vehicle even when the modelling indicates that everyone should be able to evacuate.*' One of the authors was S. Molino from Molino Stewart Pty Ltd and another was P. Cinque from the NSW SES.

[12] Are There Better Ways to Quantify Flood Risk to Life? by S Molino; M Davison; A Tagg; and P Cinque

Newgate Research[13] indicates that up to 50% of those evacuated or who reside within the evacuated area will attempt to return during the evacuation period. Therefore, it follows that even if a proportion of the at-risk population can be "evacuated", up to half of that evacuated population will seek to return to their dwellings during the flood, thereby placing them at increased risk.

The assumption imposed on Molino Stewart (we believe by the NSW SES) that shelter-in-place is an unacceptable emergency response in a flood is flawed where that shelter comprises habitable areas located above the predicted peak level of the PMF and where the residents of those premises would be isolated for less than 2 days. **There is no formal government policy** that states that shelter in place is not a viable or acceptable mode of emergency response in floods.

As previously stated, **evacuation needs to be viewed as a scalable activity** which can be **partial, phased, involve self-evacuation and shelter in place.** We contend that the Molino Stewart report ignores valid opportunities for phased evacuation by pedestrian/foot to transport hubs, as well as the feasibility of shelter in place.

While the proposed and approved Benedict/Mirvac development sites provide safe pedestrian access for evacuation if required, the evidence contained in the report by Molino Stewart clearly supports the position that a 100% compliance rate with evacuation warnings is unrealistic.

As mentioned earlier in this report, the 2021 NSW SES Liverpool City Flood Emergency Sub Plan includes the strategy that '*people who are reluctant or refuse to comply with any Evacuation Order will be referred to the NSW Police Force'*.

We submit that this is an acknowledgement by the NSW SES of the very real scenario where a proportion of residents will refuse to leave even when directed to do so. As demonstrated in the recent Covid 19 response, many residents in these areas will also not open their doors to a uniformed person, due to their past interactions or experiences in the country that they have come from. Therefore, you will never achieve 100% evacuation compliance as sought by the NSW SES. It is clearly an unrealistic assumption as it disregards known human behaviour.

Evacuation route modelling not taking into consideration local evacuation centre in Liverpool

For the purpose of the modelling, it has been assumed that all residential evacuees will head north on the M7 towards the M4 and the Homebush Evacuation Centre. The Molino Stewart March 2022 report, (page 75) provides contradictory statements in relation to this assumption. The report states '*It is noted that in reality, most people will make their own accommodation arrangements with only the residual travelling all the way to evacuation centre/s'*, but in the next paragraph states '*it is reasonable to assume that most residential traffic will travel north on the M7*' (towards Homebush).

[13] Newgate Research (June 2018) *Flood Evacuation Social Research*

This assumption fails to take into consideration the establishment, when necessary, of a Flood Evacuation Centre in Liverpool. During flooding in April 2022, an evacuation centre was established at the Whitlam Leisure Centre, 90 Memorial Avenue, Liverpool.

While evidence[14] shows that most affected residents will make their own arrangements to stay with family, friends or at alternative accommodation outside of flood affected areas, the provision of an evacuation centre in nearby Liverpool is a far more attractive proposal for those seeking refuge than a lengthy trip to the larger evacuation centre at Homebush. This would have an immediate impact on the volume of traffic travelling north along the M7 towards the M4. The Newgate Research indicated that only 17% would travel to designated evacuation centres and only 7% would use the M7 to get to safety.
The recent flood experience in 2022, where evacuation orders were given to nearly 500,000 residents in the Hawkesbury Nepean Valley/Georges River area, identified that a Mass Care Facility at Homebush was not opened. Instead, localised evacuation centres as described above were opened and managed.

Warning times

In a presentation at the First International Conference on Evacuation Modelling and Management[15], the authors (all then employees of NSW SES) state '*the modelling has guided the development of a strategic flood response plan for the Hawkesbury-Nepean Valley'* and '***the modelling showed that flood evacuation capability as it stood in 1997, was seriously deficient in terms of road traffic carrying capacity***.' We submit there are two significant issues identified in these comments – **the model was developed in 1997, and for an area of NSW that was then very much a rural location and massive Government investment in the region since, has significantly improved its road and transport infrastructure.**

The NSW SES Timeline Evacuation Model assumes that an evacuation order is not received at a property until it is doorknocked. This may have been appropriate in a rural setting in 1997, although the authors of the presentation referred to above also stated that '*in a real flood situation the SES will also use other warning methods including television, radio, and telephone. The time frame for warning delivery by these methods is likely to be shorter than for doorknocking but there is no way of assessing beforehand how long it will take for the community to receive the warning'*. The presentation also highlights what we consider are further limitations of the Timeline Evacuation Model:

- for clarity and ease of analysis, each time element has been shown as a discrete element and some of these are indicated to be entirely sequential and independent. In practice most elements will be, to some extent, concurrent
- experience of actual flood evacuation operations within the SES has shown that the elements of warning the community and the resulting traffic movement usually take place concurrently.

[14] Newgate Research (June 2018) *Flood Evacuation Social Research*
[15] Opper, S., Cinque, P. & Davies, B. (2010) *Timeline modelling of flood evacuation operations*

The presentation further states that '*the estimated warning time should not be reduced by relying on technological approaches or the uncertain outcomes of public flood education without reliable evidence justifying this reduction*'. Given that the presentation was delivered in 2010, **we submit that such evidence now exists** to justify the acceptance of more innovative means of delivering evacuation warnings and orders.

The Victorian SES, in a submission to an Inquiry into Flood Mitigation Infrastructure in Victoria (2011), advised that '*It is essential that flood warnings be disseminated through multiple mediums. Improved technologies such as Emergency Alert and social media have provided additional tools for VICSES to deliver warnings and community information during events. Warnings systems should also communicate to people from Culturally and Linguistically Diverse (CALD) backgrounds and vulnerable groups in communities.*'

The Queensland Government[16] advises that **'***A variety of warning sources increases the likelihood that warnings will be maintained throughout a flood event.*'

The NSW SES website also refers to multiple means of delivering flood and evacuation warnings and orders – of which doorknocking is one.

It should be noted that Liverpool council has previously approved 'The Marina' development parking for 637 vehicles to support the marina and recreational uses. The alternate Mirvac Planning Proposal for this site (RZ-5/2018) incorporates 624 parking spaces (which is 13 less parking spaces) on the already approved marina consented allowance. The actual number of vehicles on the site could be accommodated in extra warning time through the increase of 600 vehicles per hr/lane to a more realistic number such as 900 vehicles per hr/lane. This could be readily achieved given that evacuation for this development will not rely on door knocking and can instead be initiated electronically (SMS and Sirens) for this strata/commercial development and the Marina facility Management would be in control of the operation and hence, the customers using the facility.

The evacuation time should also be considered in terms of impact of the Mirvac Planning Proposal and would in fact be the same as for the already approved Benedict Marina Project (637 car parking spaces).

In relation to the proposed developments, additional protective factors will be implemented. These include:

- a 'community manager' who would assist NSW SES personnel in the management of the flood evacuation procedures by communicating with all residents using SMS and social media
- Residents as Flood Wardens. The wardens would assist with explaining details of the flood evacuation procedures to residents and assist in the annual flood evacuation training exercises

[16] www.chiefscientist.qld.gov.au *How do we communicate and warn about floods*

- Audible and visual alarms. It is recommended that automated SMS messaging to residents be prepared in multiple languages to cater for residents from non-English speaking backgrounds
- Vehicle and pedestrian flood evacuation route signage permanently in place

Conclusion

It is our expert opinion that as it currently stands, the Molino Stewart Report is based on either overly conservative or unrealistic assumptions, and incomplete/out of date data, that mainly have been provided by the NSW SES (our understanding). Our expert opinion is that the report **did not accurately** consider the following:

- A phased approach to evacuation considering pedestrian, vehicle and shelter in place.
- Assumptions made by the NSW SES indicate that they appear to be out of touch with the realities of urban living in a city that must be designed to cater for future population growth, based on the modes of transport that the growing population is adopting (alternates to vehicular transport).
- Traffic lane capacity based on a unreasonably conservative figure of 600 per lane/hour when they are well aware that the roads around the proposed development are not rural and will be familiar to the majority of road users.
- Referring to expected traffic delays caused by vehicles making their way north on the M7 to Homebush when their own comments, supported by independent research, clearly indicate that only a small proportion of residents would follow this path. Also, they have not factored into the modelling, the Liverpool evacuation centre or travelling to or sheltering with nearby family and friends.
- 100% evacuation compliance is a known fallacy that cannot be achieved, yet Molino Stewart used this as a base assumption.

It is our expert opinion that had the correct assumptions, along with current evacuation triggers, been provided to Molino Stewart by the NSW SES (and adopted) and consideration was given to the phased approach to evacuation modelling, different, more realistic conclusions would have been reached.

Annexure – CV Dave Owens APM

David Owens APM MLshipMgmt MEmergMgmt DipCrim
Managing Director
Risk-e Business Consultants

David established Risk-e Business Consultants, an Executive Level Management Consultancy, when he retired as Deputy Commissioner of the NSW Police Force after over 30 years of service. The NSW Police Force is Australia's oldest and largest policing organisation and one of the biggest in the English-speaking world. As the Deputy Commissioner, David was responsible for the leadership and management of nearly 13,000 police and 1200 public servants, with responsibility and accountability of a budget of $3 billion.

David has demonstrated that he clearly understands that large organisations must establish robust accountability mechanisms for crisis & emergency management, fiscal responsibility, project and performance management. Whilst strategically focused on the areas of human resources, operations and finance, he also ensured that innovation and project management was incorporated into all aspects of his work. This leadership was recognised in the awarding of the 2012 Australian Business Awards for Innovation and Project Management (project Eyewatch).

David worked with all levels of Government (Federal and State) along with private organisations and volunteer groups. David has effectively worked with Senior Executives at The Federal Bureau of Investigations, The Vatican, The Olympics, Ministers of Parliament (Federal & State) and Boards of Companies/ Emergency Services. In 2009, David was selected as the only Australasian representative to attend the National Executive Institute conducted by the FBI with participants selected from around the world for their leadership abilities.

David has performed in various roles which include Venue Commander for the Sydney 2000 Olympics, Operation Commander, Operation CONTEGO (APEC 2007 Leaders Week) having responsibility for policing & security arrangements. He was also the overall Operation Commander, Operation ANGELUS (World Youth Day 2008) during which His Holiness Pope Benedict XVI conducted services for over 500 000 pilgrims in Sydney.

David was appointed to the legislative role of State Emergency Operations Controller (SEOCON) on 01 December 2007 and performed this position for some four years, making him the longest serving officer in this role. As SEOCON, he was responsible for overall emergency management responses within the New South Wales. A sample of some of the Operations that he conducted are: Sydney 2000 Olympics, Venue Commander, Sailing; Equine Influenza (2007) with Department of Primary Industries; Pasha Bulka and North Coast Floods (2007); Black Saturday Bushfires Victoria (2009) 150 staff deployed; Emergency Management for World Youth Day and APEC Leaders Week; Christchurch New Zealand Earthquake 2011; Japanese Tsunami (2011) Urban Search & Rescue Deployment and United Nations Urban Search & Rescue accreditation Turkey (2011).

In addition, he **represented the NSW Police Force on the State Emergency Management Committee and State Rescue Board respectively, significantly contributing to planning and policy development.** David was the corporate sponsor and driving force behind the implementation of the NSW Police Force Mental Health Intervention Team (MHIT) which is now recognised as International best practice. He also implemented the Incident Commanders

course and the standardisation of Operational Risk Management for the NSWPF. David was responsible for the introduction of the *EyeWatch* project in 2011 which is a platform for the delivery of information to the community utilising *Facebook* as the network tool. This effectively created 21st Century Neighbourhood Watch Communities. This project won the 2012 Australian Business Awards for Project Management and Innovation.

Transitioning from Government to the Private sector, David has been a consultant to the NSW and ACT Governments on Investigations, Policy Development and Emergency Management. David has also worked with the Office of Liquor, Gaming and Racing (investigations and policy advice); Ambulance NSW (Strategic reviews and leadership development); Customer Service (Investigations), Sydney Metro Trains (Emergency and Crisis Management Exercises and coaching) and in **2015 was the independent Chair for the NSW Government on Loose Fill Asbestos Insulation (a $280m project), all recommendations accepted by NSW Government.** David has also consulted to private industry on a range of issues in the security and emergency management arenas and in 2014 David completed accreditation as an OGC Gateway Review Team Member. In 2015 David was appointed by the State Emergency Management Committee as the facilitator for the Greater Sydney Mass Care Exercise. In June 2016, appointed as the NSW State Recovery Coordinator for the East Coast Low and in September 2016 as the Regional Recovery Coordinator for the Central Western floods. In 2017, David was appointed by the NSW Government to the NSW Energy Security Taskforce. State Emergency Management Committee (Exercise Lumen Tenebris) 2018 – largest public/private partnership exercise conducted NSW. 2018 facilitation of NSW Health Influenza Pandemic Exercise and ANSTO Health Supply Workshop. 2018 – NSW Govt Summer Readiness Review. 2019 ANSTO (Executive mentoring), **2019 State Emergency Management Committee Catastrophic Flood Exercise Hawkesbury Nepean (4 months planning & facilitation). 2020 Co-Lead NSW Independent Bushfire Inquiry (76 Recommendations accepted by NSW Govt) and rewrite of the Hawkesbury Nepean Valley Flood Emergency Sub Plan (highest insurance risk in Australia).** Fresh Hope – Master EM, BCP and 8 Individual BCP Plans. Georges River LEMC – EM Plan, Lecturer, National Centre for Emergency Management Studies. Exercise Development & Facilitation Big Fat Smile Childcare, WestConnex M4/M5 tunnel extension and New Haven Farm Home Disability Services. 2021 Review Response Wingecarribee Shire Council 2019/20 Bushfires. Consultant Subject Matter Expert LEAMAC Property Group on flood plain management. **Commonwealth National Resilience & Recovery Agency (10 Emergency Management Exercises – 2021/22)**

QUALIFICATIONS:

David holds two (2) Masters in Emergency Management (2013) and Leadership and Management (2011); Diploma in Criminology (1998); Graduate Certificate in Management (1999) and attended the National Executive Institute Session XXXIV, Federal Bureau of Investigation (FBI), 2009. Certificate IV in Training & Assessment (2015); Diploma of Security & Risk Management (2017); Master Licence (Security Industry Act) and Master Licence (Commercial Agents and Private Inquiry Agents Act). Mental Health First Aid Australia (2017).

Lecturer, National Centre for Emergency Management Studies (2021 – current) Professor/Lecturer Rabdan Academy UAE Integrated Emergency Management (2021 – current)

AWARDS:

David has received the following awards: National Medal (1997 & 1st Clasp)), NSW Police Medal (1st, 2nd & 3rdClasp); Three Commissioner's Unit Citations; Commissioner's Olympic Commendation; Two Commissioners Commendations; Australian Police Medal (2007) and the NSW State Government Service Medal. 2012 Australian Business Awards for Project Management and Innovation. Resilient Australia Award Government Category – Activate Wollondilly project (2018)

AFFILIATIONS:
Member International Association of Emergency Managers; Risk Management Institute of Australia; ASIAL (Australian Security Industry Association Ltd) and NSW Police Legacy – Backup for Life Program. Westpac Helicopter Rescue Service (Chair/Board Member 2012-2018) NSW Ambulance Board (2019 – current). Career Transition Program Worksafe Solutions (2019 – 2021)

PUBLISHED:

- Public Private Partnerships Exploring the opportunities (2014 – ASIAL Security Insider);
- Independent Review of the NSW SES Operational Response Northern River Floods 2017;
- Harnessing the power of Social Media in Emergency Management and Community Engagement (2013 Disaster Management conference paper);
- Exercise Lumen Tenebris (Australian Police Journal Sept 2019);
- NSW Bushfire Inquiry (August 2020)
- Wingecarribee Shire Council Response to 2019/2020 Bushfires (August 2021)

ATTACHMENT C
SES Letter in response to the Mirvac PP
29 January 2024

m 0409 912 631 e mark.tooker@tookerandassociates.com.au a 30 Walworth Avenue, Newport abn 39 619 046 070

Our Ref: ID2256
Your Ref:

29th January 2024

Elizabeth Kimbell
Department of Planning, Housing and Infrastructure
Locked Bag 5022
Parramatta NSW 2124

email: elizabeth.kimbell@dpie.nsw.gov.au

Dear Elizabeth,

Planning Proposal for 146 Newbridge Road, Moorebank

Thank you for the opportunity to provide comment on the Planning Proposal which seeks to amend the Liverpool Local Environmental Plan (LEP) for 146 Newbridge Road, Moorebank (the Site).

We understand that the Moorebank East precinct has been subdivided into three main development sites:

- Georges Cove Residences (Site C), which is a previously approved medium density residential development currently being constructed by Mirvac.
- Georges Cove Village (Site A), which is likely to be developed as a commercial and light industrial facility subject to a separate Planning Proposal.
- Georges Cove Marina (Site D), **which is the subject site for this Planning Proposal.**

The Planning Proposal[1] for Georges Cove Marina seeks to:

- Include two additional permitted uses of residential accommodation and restaurants or café's, within the existing RE2 Private Recreation Zone.
- Increase the number of dwellings by 374, the on-site population by between 842-1029 people, and the number of car spaces by 592.
- Increase the density of at-risk population by amending the Maximum Floor Space Ratio from 0.25:1 to 0.4:1.
- Increase the density of at-risk population by amending the Maximum Height of Buildings from 21m to 35m.

We note from the Flood Impact Assessment that *"This Planning Proposal for the Mirvac Georges Cove Marina (site D) adopts the Council approved landform, basement carpark, southern area ground car park and Boatshed from the approved Benedict Georges Cove*

[1] EMM. 2023. Georges Cove Marina: Modified Planning Proposal.

Marina development and provides retail and open space on the ground floor and apartments and terraces on level 1 and above." [2]

The NSW State Emergency Service (NSW SES) is the agency responsible for dealing with floods, storms, and tsunami in NSW. This role includes, planning for, responding to, and coordinating the initial recovery from floods. As such, the NSW SES has an interest in the public safety aspects of the development of flood prone land, particularly the potential for changes to land use to either exacerbate existing flood risk or create new flood risk for communities in NSW.

The consent authority will need to ensure that the planning proposal is considered against the relevant Ministerial Section 9.1 Directions, including 4.1 – Flooding and is consistent with the NSW Flood Prone Land Policy as set out in the Flood Risk Management Manual 2023 (the Manual) and supporting guidelines, including the Support for Emergency Management Planning. Key considerations relating to emergency management are outlined in Attachment A.

In summary, we:

- **Recommend** reconsidering the proposed residential development on the site, as:
    - *"The properties along Newbridge Road in Moorebank, (..) are located on **one of the worst flood ways in NSW**"* [3], as noted in the meeting minutes of Liverpool City Council meeting held in March 2022.
    - It is located on a high-risk floodplain as identified in the NSW 2022 Independent Flood Inquiry.
    - The Molino Stewart evacuation report [4] states "*Development at Moorebank East should be restricted, considering it is estimated that half of the potential evacuation capacity is taken up by the already-approved Site C development.",* and also states that *"planning proposals for Moorebank East (..) would take up road capacity currently used by Chipping Norton evacuees and thousands would be caught by floodwaters who would otherwise have time to escape".* Further information on evacuation constraints is detailed in Attachment A.
- **Recommend** that Council's Georges River Flood Study 2020, although not yet adopted by Council, is used to determine the flood risk on the site, to use the best available information. This study indicates that the entire proposed development site is in a high flood risk precinct.[5]

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[2] Tooker and Associates. 2023. Flood Impact assessment and Flood Emergency Response Plan. Section 3 Site Description, Page 2
[3] Liverpool City Council. 2022. Minutes of the Ordinary Meeting held on 30 March 2022. Item No: QWN 02, Page 27
[4] Molino S. 2022. Georges River Evacuation Modelling – Flood Evacuation Analysis, Final. Pages viii - ix.
[5] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium, Flood Risk Precinct - Figure A-20

- **Recommend** seeking advice from NSW Reconstruction Authority regarding the proposed development
- **Recommend** careful consideration of the site to ensure that the proposed buildings are not subject to high hazard floodwater. The current proposal would be subject to high hazard (H5 and H6) floodwater and potential debris during frequent flood events, which poses a risk to the structural safety of the buildings supported by the supporting piles.
- **Recommend** that any proposed basement carparking is designed to ensure that it is passively protected to the Probable Maximum Flood (PMF) – i.e., that all entrances and openings (vents, etc) are located above the PMF.
- **Recommend** further consideration of safety features for any proposed lifts, to ensure floodwater does not enter the lift and ensure people do not exit into flooded areas.
- **Recommend** ensuring that any proposed plant rooms, service rooms and waste storage are located above the PMF, to minimise disruption to essential services and reduce risks of exposing persons onsite or downstream to polluted floodwater.

You may also find the following Guidelines, originally developed for the Hawkesbury Nepean Valley and available on the NSW SES website useful:

- Reducing Vulnerability of Buildings to Flood Damage
- Designing Safer Subdivisions
- Managing Flood Risk Through Planning Opportunities

Please feel free to contact Peter Cinque via email at rra@ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence. The NSW SES would also be interested in receiving future correspondence regarding the outcome of this referral via this email address.

Yours sincerely

Nicole Hogan
Director Emergency Management
NSW State Emergency Service

ATTACHMENT A: Key Emergency Management Considerations Relevant to the Site

Increased Exposure to Flood Risks

The proposal is situated on a high-risk floodplain as identified in the NSW 2022 Independent Flood Inquiry[6] and highlighted in meeting minutes of Liverpool City Council meeting held in March 2022, which states *"The properties along Newbridge Road in Moorebank, (..) are located on one of the worst flood ways in NSW."*

Recommendation 22 and 15 of the NSW 2022 Flood Inquiry[7] advocates for a planned retreat from areas at most risk on the floodplain. The proposed development is essentially an advance into the floodplain. The Inquiry also recommends that essential services and floodplain infrastructure is situated above the Flood Planning Level (Recommendation 28). It would be challenging to ensure the communications, water, power, and sewerage etc. would be above the Flood Planning Level, whether it be the current 1% AEP flood plus 0.5 metres freeboard or revised.

Increased Risk to Life

Decisions on development within the floodplain does not increase risk to life from flooding and should consider the full range of risks to the community. The site is impacted by floods as frequently as 5% AEP events, below the current Flood Planning Level. In a 1% AEP event, the flood depth in part of the site can reach above 5 meters[8] and the flood hazard level reaches H5 – H6[9], which is "***unconditionally dangerous and unsuitable for any type of development***" and classified as a high-risk precinct.[10] Further, "*the high flood risk area is where high flood damages, potential risk to life, or evacuation problems are anticipated.* ***Most development should be restricted in this area.***"[11]

In an **Extreme Flood,** the flood depth on the entire site can reach above 10 meters[12], with a flood hazard level of H6 for the entire site,[13] with the northern part of the site becoming a **floodway**.[14] Any development on the site is therefore likely to result in changes to flood behaviour and be at risk of failure. We therefore highly recommend consulting DCCEEW regarding the flood impacts on the infrastructure and on surrounding sites.

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[6] NSW Government. 2022. Independent Flood Inquiry.
[7] NSW Government. 2022. Independent Flood Inquiry.
[8] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Figure A-05
[9] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Figure A-13
[10] BMT. 2020. Georges River Flood Study - Final Draft Report. Section 7.4 - Flood Hazard. Page 140
[11] BMT. 2020. Georges River Flood Study – Final Draft Report. Flood Risk Precincts, Page 142
[12] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Figure A-8
[13] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Figure A-15.
[14] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Flood Function – Figure A-11

The site is identified as a Low Flood Island, meaning it is isolated prior to becoming inundated. The site access is subject to frequent flooding. Low Flood Islands represent a significant risk factor that would be best avoided for development due to the difficulties in carry out large scale evacuation operations, resulting a large risk of mass rescue, as detailed in subsequent sections.

There are a number of significant secondary risks associated with Low Flood Islands that must be considered. When evaluating potential impact, the risk of isolation, secondary risks and human behaviour should be considered. There is no known safe period of isolation in a flood, though the longer the period of isolation, the greater the risk to occupants. Risk to occupants may be compounded by secondary risks such as fires or medical emergencies. There is also the risk that people will not follow emergency management plans, for example they may refuse to remain isolated from family for an extended duration.

Emergency services are also exposed to greater risks than if flood-free access was available. This unnecessarily exposes emergency service personnel to flood situations which may lead to the injury or death. In recognition of this possibility, emergency services are under an increasing demand to consider the safety of personnel. Each circumstance must be subject to an individual risk assessment at the time. If, after conducting a risk assessment of an incident, a Commander or team leader is unsatisfied with the level of risk involved, the response will be delayed until the risk can be reduced or is no longer present.

The probability of a fire occurring on a site whilst it was isolated and surrounded by floodwaters would be greater due to power surges, electrical faults and the use of ad hoc heating and lighting measures such as candles. The likely delay in response times during floods would greatly exacerbate the chances of a fire spreading from its point of origin, of which increases the risk of injury or death to occupants of the building. This was the case in the 2011 Brisbane floods where a fire broke out inside Suncorp Stadium (Lang Park), which was flooded at the time.

There is limited evidence to indicate that there would be structural stability of the buildings located in the high hazard floodway. The Flood Impact Assessment states *"The building platform will provide a low flood hazard environment"* [15] , however, we recommend considering the structural suitability of the placement of the proposed development in high hazard floodwater, considering the forces of the floodwater as well as debris loading on the building structure.

[15] Tooker and Associates. 2023. Mirvac Georges Cover Marina Flood Impact Assessment and Flood Emergency Response Plan v4 010823, Section 8.3, Page 13

The proposed development is stated to include buildings *"supported on piles to form more flood storage"*[16] and that *"flood flows would be designed to pass under the carpark".* [17] These supporting piles are expected to become subject to high hazard floodwater during frequent flood events, which poses a risk to the structural safety of the buildings supported by these piles. When considering the post development landform heights compared to the predicted benchmark pre-development flood levels (Cardno 29 Jan 2013), we understand that the supporting piles are expected to become subjected to high hazard floodwater (H5, and potentially H6, due to flood depths >2m) in events as frequent as a 20 year ARI flood event.[18] This is consistent with the updated flood modelling from 2020, where the location of the proposed development [19] is located on land that is modelled to become inundated by floodwater with depths of 3-4m or greater in a 5% AEP event[20]. The modelling also shows that high hazard (H5) floodwater would be present on the site of the proposed development in more frequent events such as the 20% AEP flood event.[21]

Furthermore, the proposal includes basement carparking which is impacted as frequently as the 1 in 20 year ARI. Basement car parks have inherent risks to life and property[22] and can often restrict safe evacuation of the occupants. This can be managed through building design, such as crest levels and vents above the PMF to prevent water ingress and flooding and protection of list services to ensure lifts to not put people into floodwater.

We are aware that a previous Land and Environment Court decision (Moorebank Recyclers Pty Ltd v Benedict Industries Pty Ltd and Ors [2018] NSWLEC 1089) refused development at the site due to the potential contamination and impact on water quality. This risk would also impact on the health and safety of any volunteers that would be involved in response operations for the site or people using the site if they entered the floodwaters.

Increased Demand on Emergency Services

The area is an existing flood rescue hotspot for NSW SES, which would be exacerbated by increasing the density of the population at risk. According to the Georges Cove Marina Modified Planning Proposal (2023), *"the Social Impact Assessment (SIA) identifies that the proposal to provide 374 new dwellings for the Moorebank East precinct will generate an*

[16] Tooker and Associates. 2023. Mirvac Georges Cover Marina PP Flood Impact Assessment and Flood Emergency Response Plan v4 010823, Section 3, Page 3
[17] Tooker and Associates. 2023. Mirvac Georges Cover Marina PP Flood Impact Assessment and Flood Emergency Response Plan v4 010823, Section 3, Page 3
[18] Tooker and Associates. 2023. Mirvac Georges Cover Marina PP Flood Impact Assessment and Flood Emergency Response Plan v4 010823, Sections 3 and 4, Page 3
[19] EMM. 2023. The Georges Cove Marina - Modified Planning Proposal. Section 5.3.7 Social and Economic Effects, Page 12
[20] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Figure A-3, Page 5
[21] BMT. 2020. Georges River Flood Study - Final Draft Mapping Compendium. Figure A-1, Page 3
[22] Collier, L. Phillips, B., and Griffin, M. 2017. Basement Development in the Floodplain. Floodplain Management Australia Conference. Newcastle, 2017.

increase in the Moorebank population by between 842 to 1,029 people, in particular increasing the numbers of families with young children in the precinct." (pg. 45) [23]

Several flood rescue jobs have historically been responded to by the NSW SES in the area, as recently as 2020, 2021 and 2022. This includes responding to people trapped in their cars and properties by floodwaters and ambulances being unable to reach patients to provide emergency medical assistance.

Elevated structures to achieve compliance with habitable floor levels, although effective for property protection, brings with it the problem that residents will be convinced that it is safe to "sit-out the flood". Unfortunately, our experience is that people change their mind about this option after they have been surrounded by flood water or when essential services such as water, power and sewer cease to function. Rescue, resupply, and medical responses are difficult and can be dangerous under these conditions. Building stability can also be an issue, particularly in high hazard floods where all buildings are susceptible to structural failure. In summary, **NSW SES resources will be required to rescue and/or resupply occupants due to less than 100% evacuation.**

Consideration of Climate Change

Climate Change has not currently been adequately considered to ensure risks are understood and managed for the future users of the site. Continuing research by the Bureau of Meteorology and the CSIRO predicts more intense, short duration heavy rainfall events. The projected increase in heavy rainfall will increase flood risk in cities, built-up urban areas, and small catchments, where extreme rainfall over hours to a day not only can result in riverine flooding but can also quickly become flash floods and cut roads prior to the onset of riverine flooding.

Risk to Life Treatment Options

Evacuation

Development of the floodplain should have sufficient evacuation capacity and should not impact on the ability of the existing community to safely and effectively respond to a flood. The existing assessment does not adequately consider the cumulative impacts the development will have on risk to life and the existing and future community and emergency service resources in the future, including the converging evacuation traffic from the existing and proposed adjacent developments along Georges River. The ability of the existing community to effectively respond (including self-evacuating) within the available timeframe on available infrastructure is to be maintained. It is not to be impacted on by the cumulative impact of new development.

[23] EMM. 2023. The Georges Cove Marina - Modified Planning Proposal. Section 5.3.7 Social and Economic Effects, Page 45

The Georges River Evacuation Study (Molino Stewart 2022) highlighted the limitations of the existing road network to accommodate the large number of developments proposed for this area. The assumptions of the NSW SES evacuation model are explained in the Hawkesbury Nepean Flood Evacuation Model Report.

NSW SES is the legislated authority for planning for and coordinating the evacuation of people affected by flooding. To assist in this, NSW SES creates sub-sectors that align to the Flood Emergency Response Classification of Communities. An appropriate emergency response strategy is applied accordingly. For example, properties situated on a low flood island would need to be evacuated before they become isolated to avoid the need for mass rescue. However, neither the NSW SES nor the Bureau of Meteorology can provide special individual flood warning services for each business site. Any proposed Emergency Management strategy for an area should be compatible with the evacuation strategies identified in the Liverpool City Flood Emergency Sub Plan or as advised by NSW SES, where evacuation is the primary Emergency Management Strategy[24].

The proposed evacuation route along Brickmakers Drive becomes inundated with flood waters as frequently as a 1% AEP event[25] and during a PMF event becomes inundated with flood waters in excess of 1m in depth[26]. During a PMF event this area is classified as Hazard Level 6 (H6)[27] which is classified as not suitable for people, vehicles or buildings[28].

The vehicle evacuation route proposed "*will be via the Mirvac Georges Cove Residences (site C) residential area (which is already at a higher than the 100 year ARI flood level) and then onto the existing high level road bridge leading to Brickmakers Drive and then onto Maddecks Avenue and Nuwarra Road. Nuwarra Road is above the Probable Maximum Flood (PMF) level.*[29]" Maddecks Avenue is a suburban street which is primarily a single lane in each direction. It includes several intersections, turning lanes and roundabouts, plus surface parking and a speed limit of 50km/h[30].

[24] Liverpool City Flood Emergency Sub Plan. Endorsed April 2023 Section 5.8, Page 16
[25] BMT. 2020. Georges River Flood Study, Final Draft Mapping Compendium, Figure A-5 1% AEP Modelled Peak Flood Depths, Velocities and Water Levels
[26] BMT. 2020. Georges River Flood Study, Final Draft Mapping Compendium, Figure A-8 Extreme Modelled Peak Flood Depths, Velocities and Water Levels
[27] BMT. 2020. Georges River Flood Study, Final Draft Mapping Compendium, Figure A-15, Extreme Best Practice Flood Hazard
[28] Department of Planning and Environment. 2023. Flood Hazard, Flood Risk Management Guideline FB03, Table 1 Combined hazard curves vulnerability thresholds
[29] Tooker and Associates. 2023. Flood Impact assessment and Flood Emergency Response Plan. Section 5, Proposed Development, Page 4
[30] Google Maps 2023 imagery of Maddecks Road between Brickmakers Drive and Nuwarra Road

This presents a 'pinch point' at the start of the evacuation route which limits traffic flow to a single lane, it is therefore not appropriate to apply "the operational capacity for basic motorway segments"[31] as traffic flow will be greatly reduced by several factors:

- Design capacity of a single lane, 50km/h road
- Reduction in traffic capacity due to impacts of on-street parking[32]
- Reduction in traffic capacity due to roundabouts[33]
- Impacts of weather conditions
- Background traffic from surrounding area not inside evacuation zone
- Cumulative impacts of other evacuating traffic noting that Nuwarra Road forms part of a major evacuation route for Chipping Norton and surrounding areas

As stated in the Georges River Evacuation Modelling Report "*Nuwarra Road is an evacuation bottle neck which may prevent the timely evacuation of parts of Chipping Norton. The provision of an additional southbound lane from Brickmakers Road to Heathcote Road and the utilisation of Brickmakers Road and Anzac Road for some of the Chipping Norton evacuation traffic may alleviate this problem[34]*". As the proposed evacuation route joins Nuwarra Road, this development would add up to 592 additional vehicles[35] (in conjunction with other vehicles from the other sites on the Moorebank East precinct) to this thoroughfare, increasing the risk of life to those already evacuating the Chipping Norton area. This would transfer additional risk to emergency services who will be called upon for rescue of those unable to evacuate.

The report goes on to state that development at Moorebank East should be restricted, considering it is estimated that half of the potential evacuation capacity is taken up by the already-approved Site C development. An additional lane on Nuwarra Road should be investigated to see whether it would provide sufficient additional evacuation capacity to enable further development at Moorebank East without compromising the safe evacuation of existing development in Chipping Norton[36]. Further, *"the vast majority of the area inundated by the Georges River PMF experiences high hazard flooding (..) for over 24 hours, in many places in excess of 40 hours. Therefore, failing to evacuate or deliberately sheltering in place*

[31] Tooker and Associates. 2023. Flood Impact assessment and Flood Emergency Response Plan. Attachment E. Risk-e Business Review - Vehicle capacity per lane during evacuation, Page 4
[32]Wijayaratna, S. 2015. Impacts of On-Street Parking on Road Capacity. *Australian Transport Research Forum Proceedings, 30 September -2 October 2015, Sydney Australia.*
[33] Austroads. 2020. Guide to Traffic Management Part 3: Transport Study and Analysis Methods. Section 7.2 Roundabouts
[34] Molino, S. 2022. Georges River Evacuation Modelling – Key Findings, Existing and Infill Development, Page V
[35] Tooker and Associates. 2023. Flood Impact assessment and Flood Emergency Response Plan. Section 6.4 Flood Emergency Response Plan, Page 6
[36] Molino, S. 2022. Georges River Evacuation Modelling – Key Findings, Existing and Infill Development, Page viii

in the Georges River floodplain is particularly risky considering buildings can be isolated and inaccessible to emergency services for more than 24 hours."[37]

Pedestrian and Rail Evacuation

It is unacceptable to expect people to escape from a flood on foot as identified in the proposal. As identified in section 7.1.5 of the Georges River Evacuation Modelling Report, it is unacceptable to expect people to escape from a flood on foot as identified in the proposal. This is particularly concerning, with the high likelihood of ongoing poor weather conditions and should not be used to justify the development. Pedestrian evacuation is a backup strategy.

Pedestrian evacuation is a rare phenomenon since car ownership became widespread and factors associated with a large-scale pedestrian evacuation are not well-understood. However, research following the 9/11 attack on the World Trade Centre indicates that the pedestrian evacuation that occurred was multi-modal, where many people walked to get a ferry, bus or train. Many complex issues were identified in this event, including the safety challenges of pedestrians and vehicles sharing routes, the large number of officials required to coordinate the evacuation on-ground, pedestrians being exposed to the weather, limited capacity to carry important documents and possessions particularly those requiring medicines or children's items and with pets.

In the context of the proposed development pedestrian evacuation would be constrained by:

- Distances that evacuees may need to travel - evacuation by foot could exceed a distance greater than 1 km from the site.
- Weather at the time of an evacuation becoming necessary - an evacuation by foot may coincide with heavy rainfall and strong winds which may dissuade people from selecting this strategy.
- Time of day - people may be reluctant to evacuate at night.
- Evacuation of people with special needs who may lack the mobility to evacuate by foot.
- Disruption to onsite and offsite infrastructure resulting in evacuees navigating streets, paths, and bridges in darkness.
- Hazards such as downed powerlines due to strong winds and storm damage.

The pedestrian evacuation route assumes evacuation to the Moorebank Library and Community Centre or beyond to the shopping centre and any nearby public transport. The Moorebank Library and community centre has a capacity of 100 evacuees while the total number of evacuees may be up to 2622 should vehicle evacuation fail or be unavailable[38]. This would necessarily require evacuees to move on, either to larger evacuation centres or to friends and family.

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[37] Molino, S. 2022. Georges River Evacuation Modelling – Flood Evacuation Analysis, Final. Page 34

[38] Tooker and Associates. 2023. Flood Impact assessment and Flood Emergency Response Plan. Section 6.4

The closest bus stops in the vicinity of the site are on Newbridge Road and are served by bus route M90, which operates from Liverpool Station to Burwood Station via Bankstown.[39] Newbridge Road at Brickmakers drive becomes inundated with flood water up to 2m in depth as frequently as a 5% AEP event[40]. This means evacuees would need to travel a greater distance to access public transport which is running out of the area.

Similarly, large scale rail evacuation in Sydney cannot be relied upon as a primary evacuation strategy or where vehicular evacuation fails during flood events. The reliability of the Sydney Rail network can be severely impacted in storms and floods. For example, in April 2015, Sydney Trains estimates nearly 200 significant incidents to Sydney Trains and NSW Trains, and approximately 585 peak and non-peak services were affected during a 3-day period of storms[41]. Compounding on this, is the increased complexity in evacuation operations arising from this strategy. For example, it would require significant resources to manage, coordinate and appropriately communicate to the community and provide adequate infrastructure and essential services while evacuees are waiting at the train station, for example toilets. People would also be attempting to carry large amounts of luggage and supplies with them, potentially with children or other vulnerable members of the community.

The private motor vehicle is therefore likely to be the most effective means of evacuation transport. The motor vehicle also provides an important although limited capacity for people to save some of their possessions, most of which will almost certainly be lost in large floods.

Addressing Risk to Life with Site Specific Emergency Planning

The NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management. Section A2.4 of the Support for Emergency Management Planning notes site-specific flood response plans as a development consent condition are not an effective measure for addressing continuing risk nor suitable for addressing the impacts of the development on emergency management risks to the existing community. This is particularly problematic where consent conditions are used to overcome a flood risk that would otherwise be considered unacceptable in the context of the proposed development.

The Flood Risk Management Manual 2023 notes flood risk management plans are 'living documents' which need to be regularly reviewed to ensure they remain appropriate to address the flood risk to the community, can be practically implemented and consider changing information and lessons learnt from any floods since the last review. This ongoing

[39] EEM. 2023. Georges Cove Marina Modified Planning Proposal, Section 5.3.4 Traffic, i Existing Traffic and Transport
[40] BMT. 2020. Georges River Flood Study, Final Draft Mapping Compendium, Figure A-3 5% AEP Modelled Peak Flood Depths, Velocities and Water Levels
[41] TfNSW. 2016. Climate Risk Assessment Guideline

review process is unlikely to be implemented in a private ownership context where there is no external audit or monitoring.

In addition to the above, the proposed site specific plan:

- Assumes that power and/or communications will still be available. There are often outages of such services during major flooding.
- Would still rely on a trigger to evacuate prior to inundation occurring. There is considerable historical evidence that some people, occasionally in large numbers, will not heed the call to evacuate early and will instead wait until they see floodwater in their immediate vicinity. In doing so it is possible that people will not have sufficient time to get off the site before floodwater encroaches around their dwelling or workplace and require resupply or rescue. In addition, if the forecast height does not result, then there is an effect on subsequent evacuation compliance rates due to the "cry wolf" effect.
- Relies on the actions of a flood warden, who is unlikely to be an emergency management expert and places significant burden on the individual to analyse and interpret flood information.
- May cause confusion and provide conflicting information. All warnings issued by the NSW SES are considered official warnings and will be viewed on the SES website and HazardWatch launched by the NSW SES on 30 September 2022 as part of the Australian Warning System. This new site is geared to displaying official NSW SES warnings and in time flash flood warnings and warnings from other emergency services. If the early warning system is pursued, the Australian Warning System terminology will not be able to be adopted unless it is an established warning system within the NSW SES framework.
- Assumes "immediate evacuation". There has been no consideration of the time required for occupants to validate and process the information (warning acceptance factor) and for them to collect their belongings or children and pets). Furthermore, no matter how many warning technologies are used, door knocking is the only way of ensuring everyone has been warned. Any time advantage is gained by the application of warning technology should be considered as a safety factor, not a potential for increasing the scale of the development and simply wiping out the safety factor with more risk exposure. In some instance, people will not be home and will return to collect their valuable possessions prior to evacuating. In other instances, it may be in the middle of the night.
- Assumes more than 12 hours is available for evacuation. The confident warning timeframe for the Liverpool flood gauge is around 12 hours for above 4 metres with a flood peak forecast criteria (70% +/- 0.3m)[42].

[42] Bureau of Meteorology. 2013. Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory

Therefore, such a private evacuation plan is not a sufficient means to mitigate the increase in risk to life, and property, as a consequence of the proposed development.

Managing Residual Risk

The Moorebank area is currently serviced by the NSW SES Liverpool Unit, supported by the Metro Zone. The resources of the Zone cover several high-risk river systems that can flood singly or in combination, along with flash flooding in the numerous creek systems. Managing evacuations is already complex. Adding additional people would further result in increased complexity and reliance on human behaviour.

If the proposed development were to proceed there would be a substantial cumulative increase in residual risk to life. This increase requires even more community engagement and preparedness programs along with stretching resources in an already complex response operations environment.

The NSW SES would require a substantial increase in response capability and resources and additional Community Engagement and Safety programs for the Liverpool LGA, for the life span of the proposed development.

Ongoing community awareness of flooding is critical to assist effective emergency response. The consent authority should consider the cumulative impacts any development will have on risk to life and the existing and future community and emergency service resources in the future. No considerations are outlined in the report as to the organisation of emergency response and how this would achieve little to no additional demand on scarce NSW SES resources.